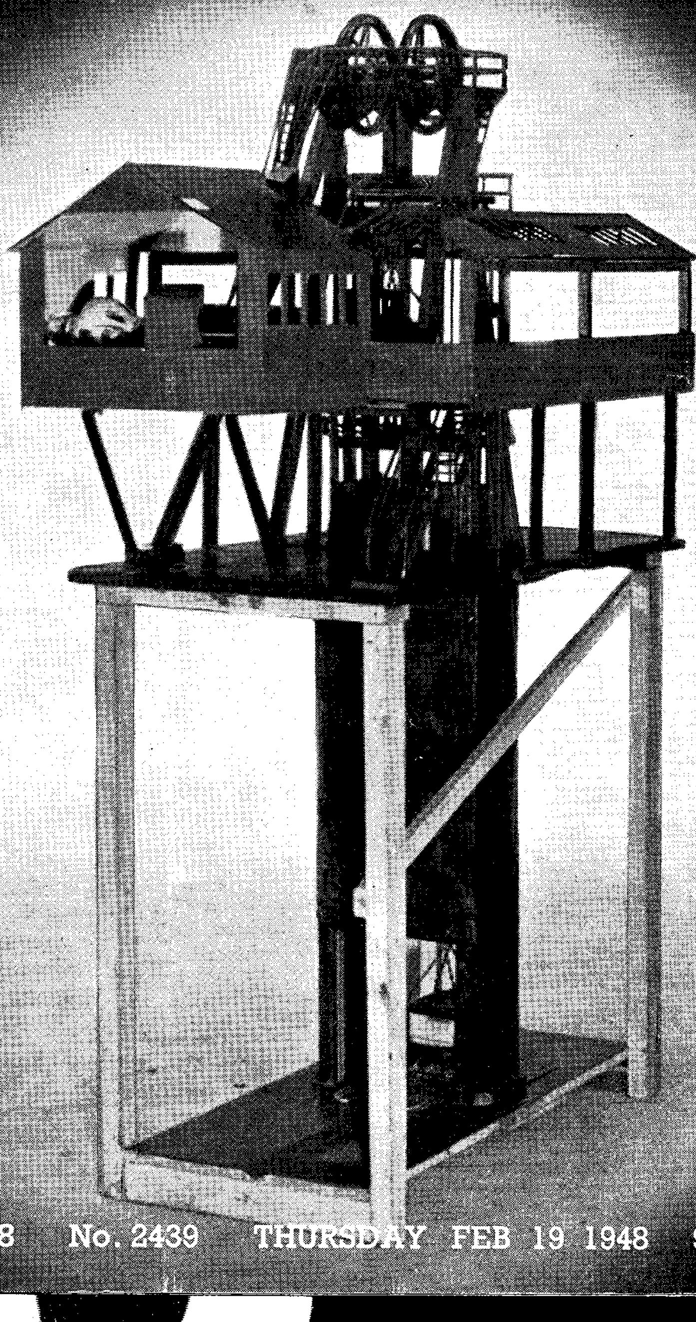
THE MODEL ENGINEER



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The MODEL ENGINEER

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Smoke Rings	183
A Triple Expansion Marine Engine	185
A Workshop Tragedy	187
A Sturdy 5-in. Gauge L.M.S. "2F"	188
Hints on Driving Large-Scale Locomotives	192
Petrol Engine Topics	193
A 10-c.c. Flat Twin Two-stroke Engine	193
A Tyneside Exhibition	196
Notes on Jet Engines	198
Solder Welding	200
A Rope-making Machine	201
Editor's Correspondence	205
Readers' Referendum	207
Club Announcements	208

SMOKE RINGS

Our Cover Picture

● THIS WEEK we illustrate a model of a Pit-head gear, made by E. Gernall, a fitter at the Crookhall Colliery, Co. Durham. This model was recently on show at an exhibition in London, of Art and Handicrafts by British Miners, sponsored by the National Coal Board.

Readers' Referendum

● IN THIS issue, on page 207, we have published a Readers' Referendum in the form of a questionnaire. We hope all our readers will take this opportunity of informing us which subjects they appreciate most, thus enabling us to devote our limited space to articles which we know will be appreciated by the majority.

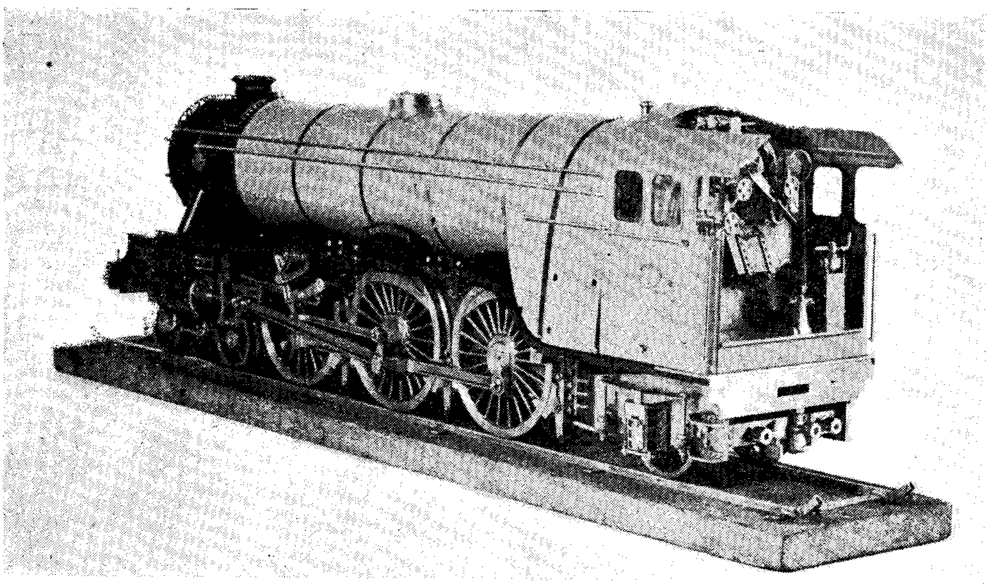
Accidents in the Workshop

● I HAVE been asked by a society secretary for some advice as to the liability of his society for claims for damages or accidents to members who may be using the club workshop. They have a rule, quoted on their membership cards, to the effect that members using the tools in the workshop do so at their own risk. My correspondent asks "is this sufficient protection in law?" I am not prepared to give a legal opinion on this point, but I think that if the rule itself were supplemented by a notice prominently displayed in the workshop, the society would be sufficiently protected. It seems to me, however, that both the rule and the notice should be worded in more general terms to cover the possibility of injury to members who may be present in the workshop when an accident occurs although they may not have been concerned in the immediate cause of the injuries. A member may suffer injury through his own carelessness, or through a defect or breakdown of the machine he is using, or he may be injured through a fire or explosion, or through the collapse of a floor or ceiling, or through the falling of a heavy weight from a bench or other elevated position. There are, in fact, many ways in which some injury may be inflicted on an innocent party, though I am glad to say that such accidents are very rare, and I do not know of any cases in which claims for damages have been made. A practical step for any society to take would be to secure an insurance policy covering all risks of this kind. In view of the limited operations carried on in a model engineering workshop I do not think this would be an expensive matter, and it would certainly ease the minds of both the executive and the members. The insurance might be extended to cover damage of members' property, such as valuable models or equipment, or personal belongings which might temporarily be housed in the workshop, and even to cover loss by burglary or theft,

especially in the case of isolated buildings. In view of the adage that "it is always the unexpected which happens," the protection by insurance is much to be commended.

A Woodwards Special

● IN A letter from Mr. A. G. Woodwards of Dunstable I found a little photograph of his latest production. He suggested that I should put a magnifying glass on the photograph and look for the meticulous detail on the model. The detail is there sure enough, and it bears the stamp of patient perfection which those who know Mr. Woodwards always associate with his work. To enable my readers to share in my appreciation of this fine model I have had the photograph enlarged for all to see. It shows a $3\frac{1}{2}$-in. gauge scale L.N.E.R. Pacific and it certainly looks to be "the goods." Many readers will remember the beautiful beam engine pumping set for which Mr. Woodwards gained a Championship Cup at a pre-war "M.E." Exhibition, one of the finest examples of engineering modelling we have been privileged to place on show. I am sure that the new locomotive will be a strong competitor for public admiration when it comes into view.



Australian Trains

● I AM indebted to Mr. A. Austin Gray of Geelong for a copy of a most entertaining and informative book entitled *The Australian Book of Trains*, published by Angus and Robertson of Sydney, price 25s. My first impression of this book is of admiration for the profuseness and high quality of its illustrations. Many of these are beautifully reproduced in colour, and the picture generally gives a comprehensive view of what railway engineering means, and has meant, in Australia. It will be readily realised that railway transport in that vast Dominion is a very different problem from that confronting our engineers and traffic managers over here. Generally speaking, the problem is one of heavy hauls over long distances, and the types of engines are largely of the six and eight coupled variety, with a strong influence of American construction and design. But the distances and the climatic conditions also affect the rolling-stock in general, and the comfort of the passengers appears to be remarkably well studied. Another striking feature is the fine terminal and administration buildings with which the Australian railways are blessed. I hope to delve more deeply into this fascinating book, for there is much in it which will interest railway enthusiasts at home. For locomotive modellers in search of new prototypes it will be an admirable source of reference.

A New Track for Chicago

● ANOTHER SPOT of news from across the water comes from Mr. Emery Ohleskamf of Chicago who tells me that the Society in that city has purchased 1,000 ft. of duralumin rail to be laid this spring in $3\frac{1}{2}$-in. gauge. He says that there are at least four engines being built in Chicago to $1\frac{1}{2}$-in. scale. They all have steel boilers and are electrically welded. He himself is building a model of an 80-h.p. "Case" traction engine to 3-in. scale. The single cylinder is $2\frac{3}{4}$-in. stroke by $2\frac{3}{4}$-in. bore, and the copper boiler will be $8\frac{1}{2}$ in. diameter. The rear wheels are $18\frac{1}{2}$ in. in diameter, with a 6-in. face. He has had some little difficulty in getting suitable copper tubing and sheet, but he will make do.

Percival Marshall

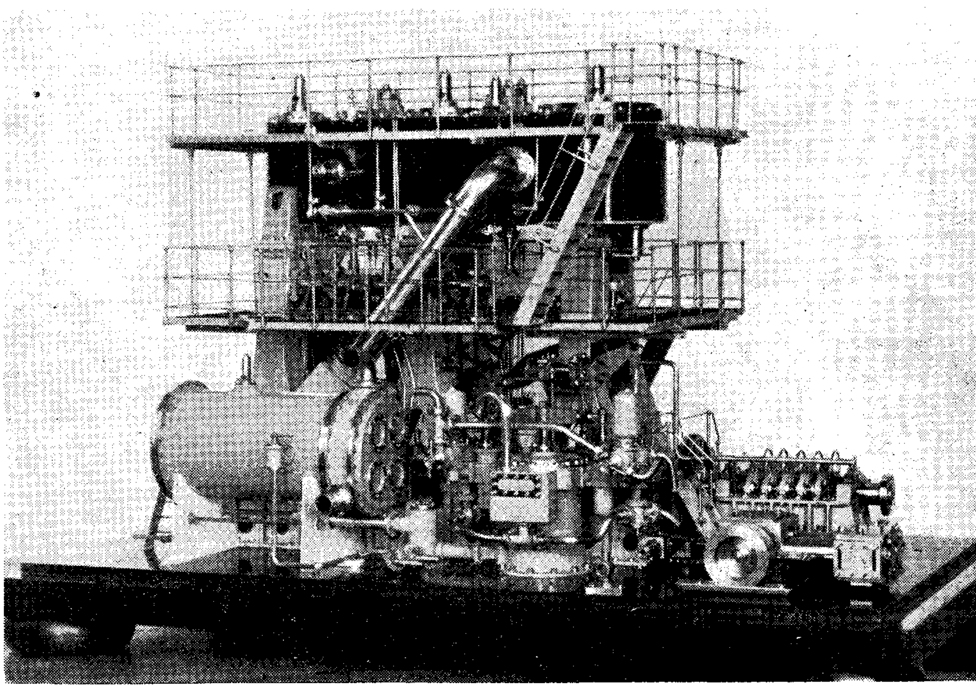
A Triple Expansion Marine Engine

by J. N. Maskelyne, A.I.Loco.E.

THE beautiful example of modelcraft seen in the illustrations herewith, as well as on the cover of our issue for January 29th last, is the fourth and last of a set of marine-engine models made by Lieut. W. T. Barker of the S.M.E.E. All four models have been characterised by exemplary workmanship and beautiful finish meticulously maintained at the same high quality throughout the long time, about 40 years, taken in constructing these models.

A generally-accepted idea among model engineers is that a model is either primarily a working one or a "show-case" exhibition model in which all the visible prototype details are accurately reduced to scale. Lieut. Barker's models, however, seem to be rather more than half-way between these two types; they are not strictly *working* models, in the sense that they are self-operating, neither are they exactly "show-case" models of the purely static kind, because they are so arranged that they can be made to reproduce the slow, ponderous and inexpressibly fascinating movements generally associated with old-time marine and beam engines.

The model illustrated here is based on a triple-expansion marine engine of a type designed and manufactured, about 1890, by Alexander Stephen & Co., the Glasgow shipbuilders. The scale is approximately ½ in. to 1 foot, though the model is not an exact scale reduction of the prototype; some liberties were taken with the bores of the cylinders, for example, so that manufacture could be brought within the capacity of a 2½-in. lathe.



View showing condenser unit and much neat piping

The double columns and guides are the archaic features of this model, and except for the bed-plate, are the only iron castings on it, the cylinders being of gunmetal. They were obtained from Stuart Turner Ltd., to patterns supplied by Lieut. Barker, and are flawless.

The only drawings used were a general arrangement of the prototype together with a few rough sketches made, when required, for some of the details. All the main details which, normally, would have been cast were built-up and silver-soldered; in modern parlance, they were fabricated to simulate castings. These details include such items as air-feed and bilge pumps, cylinder-covers, connecting-rod brasses, cross-heads and the main thrust block. The last-named of these contains some 200 separate pieces; in fact, some idea of the amount of work entailed in the construction of such an engine

as this may be gauged from the realisation that there are about 14,000 bits and pieces in it, all home-made, except about two gross of 16-B.A. brass screws used on the cylinder-lagging. Between 3,000 and 4,000 bolts, nuts, studs and screws were made in the home workshop; the hex-head screws were produced by soldering heads on to commercial screws.

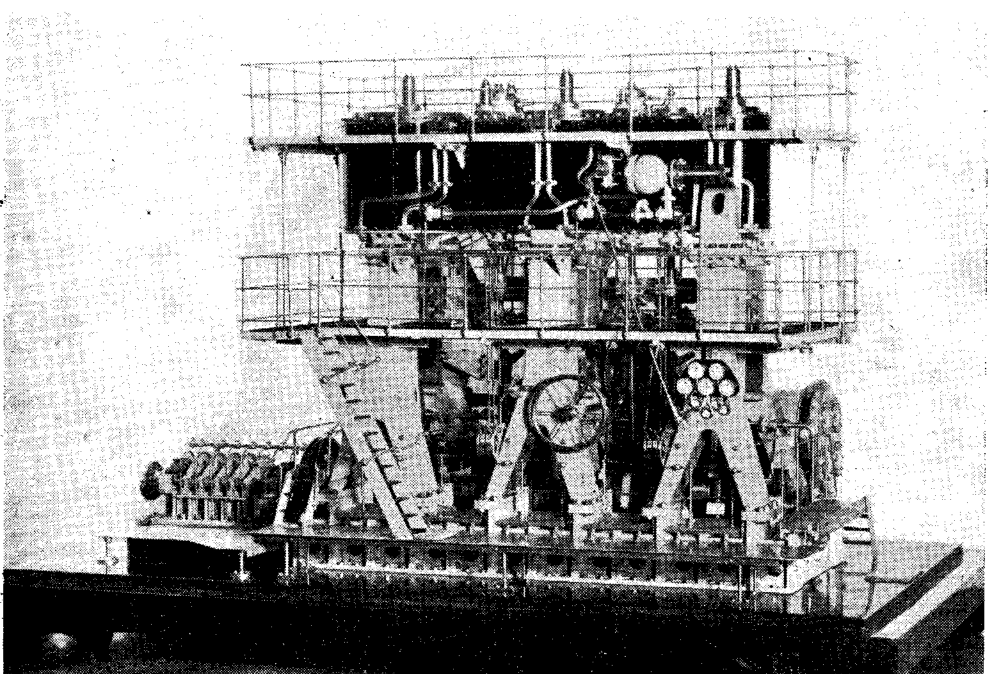
The cylinder covers are all properly ribbed, the ribs being cut out separately and silver-soldered into their proper places. The lagging is made of copper sheet, bent to shape and enamelled black. And thereby hangs a tale, the tale of sixpennyworth of arsenic.

The original intention was to apply some kind of natural black finish to the copper lagging, and consultation with fellow-members of the S.M.E.E. elicited the information that the required finish could be obtained by the use of a solution of arsenic. So a local chemist is visited with a view to the purchase of a small quantity of the dreaded poison; but there is nothing doing! Of course! Only a small amount is needed; sixpennyworth is ample. The chemist is very sorry, but *no* amount of arsenic may be sold unless the customer can produce an official permit.

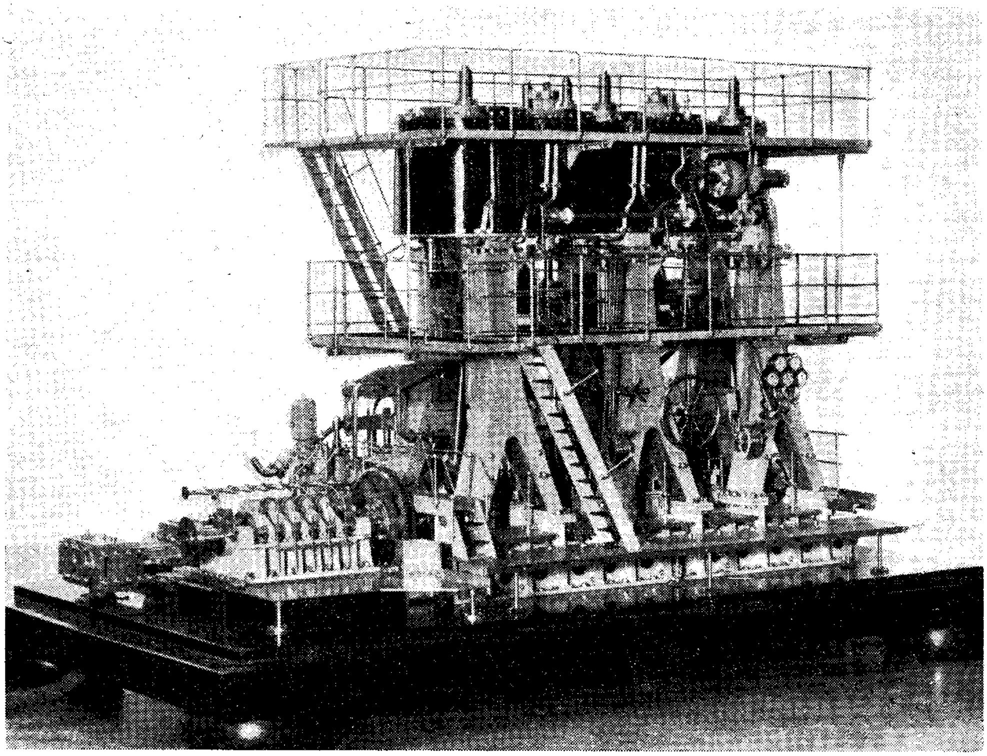
The next step is to go in search of that permit; this leads eventually to a visit from a sergeant of police who desires to investigate, dutifully and thoroughly, the reason why anybody should require a small quantity of arsenic. He is shown the model and is given a full explanation as to the use to which the arsenic would be put. History does not record whether he really and fully appreciated all that he saw; but, undoubtedly, he was sufficiently impressed to be able to report to his superior officer that the application for a permit for the purchase of a small quantity of deadly poison was, in this instance, justified. In due course, the permit was issued, the arsenic obtained and the copper lagging-plates were beautifully blackened!

But that is not the end of the story. Before long, a hideous green deposit formed to spoil the appearance of that lovely black finish. Strenuous efforts to remove it effected only very temporary improvements; verdigris is like that! Another consultation with fellow members of the S.M.E.E. brought forth the advice that the blackened copper plate should be thoroughly washed in a strong solution of carbonate of soda. This advice seemed easy to act upon; so the domestic authorities were consulted and produced the necessary soda. Strange to relate, the soda made no impression whatever upon the verdigris; several attempts led to the same result, in that the verdigris remained unaffected. Further attempts to remove it were abandoned, new lagging-plates were made and given a lovely coat of black enamel, after being fitted in place. The puzzle of the soda was resolved later; the domestic authorities had made a mistake. Instead of providing carbonate of soda (washing soda), they had supplied bi-carbonate of soda (cooking soda) which verdigris seems to find innocuous!

The h.p. cylinder is provided with a piston-valve, but the i.p. and l.p. cylinders have double-ported flat valves. The bores are respectively,



A view in which much excellent work can be seen



The main thrust block, seen at near-side left, contains more than 200 *separate pieces*

$1\frac{1}{4}$ in., $1\frac{7}{8}$ in. and $2\frac{7}{8}$ in., all with a common stroke of $1\frac{5}{8}$ in. The l.p. cylinder is a little smaller than it should be for good scale, but this is not really noticeable.

The model is arranged for driving, at slow speed, by a small compressed-air unit in the corner behind the main thrust block. The unit runs at about 1,350 r.p.m. to give the main engine a speed of some 15 r.p.m. through a 90-to-1 worm-gear. When the engine is running, the effect is most impressive, all the dignity and majesty of the prototype being faithfully reproduced.

Lubrication is provided from true-to-scale oil-boxes, and the pipe-work throughout is a real feature; it was all produced on Lieut. Barker's pipe-bending machine, illustrated and described in the " M.E." for January 9th, 1947, and there is certainly no visible blemish in any pipe, large or small.

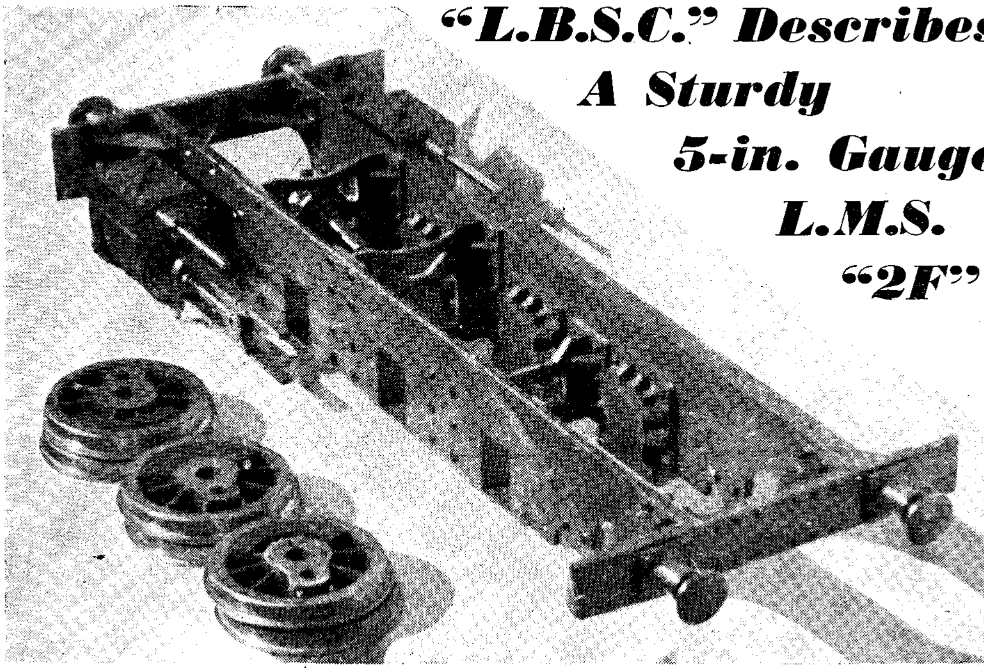
The model has occupied just under 10 years in its construction, about 8 or 10 hours per week being given to it. It and its three predecessors make up a remarkable quartette which cannot fail to arouse the admiration of everyone who sees them.

A Workshop Tragedy

EVEN model engineers' workshops are not immune from their moments of heart-breaking tragedy. The builder of a " Fayette "—seven years' work—was testing the chassis on the bench under compressed air when his dog—a cocker—raced into the workshop and became entangled in the air line. " Fayette " landed on the floor, twisted almost out of recognition. That was in 1939—our correspondent decided to re-build some time, but so many other duties have intervened that the " bits and pieces " are still reposing in the box. He tells us that he has an employee who has worked for him on one of his farms for about 35 years. This man has a philosophy for dealing with any unexpected calamity. He says " You have got to laugh " or in his own words " Yer gotter laff."

We cannot imagine any amusement on our correspondent's face as he picked up the remains of his precious " Fayette," but are there not times in life when fortune is so overwhelmingly perverse that there is nothing left to do but to " grin and bear it " ? A sense of humour is indeed a saving grace, and blessed is the model engineer who can find a " laff " in the most disheartening of workshop tragedies.

"L.B.S.C." Describes A Sturdy 5-in. Gauge L.M.S. "2F"

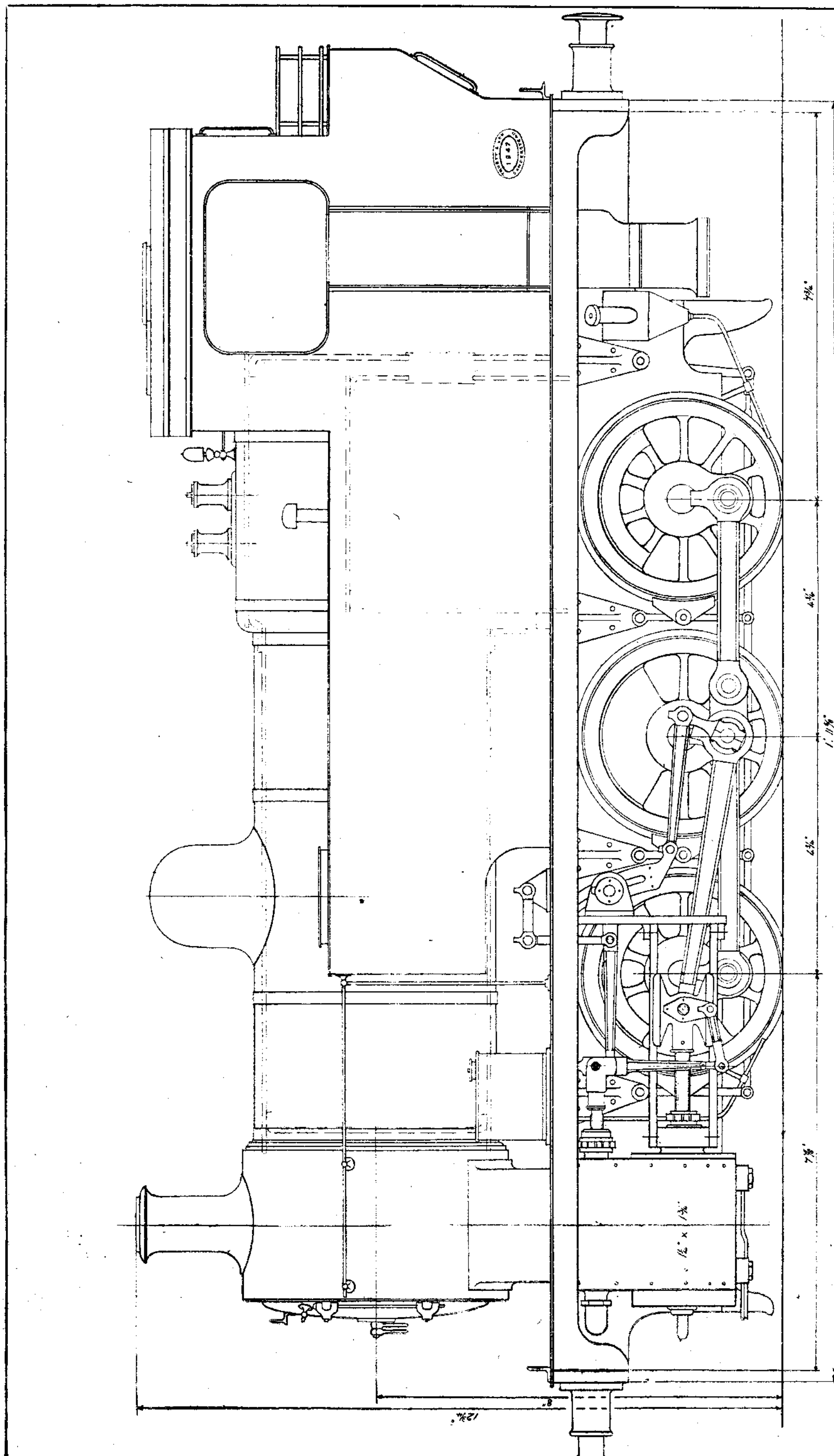


AMONG the many followers of these notes who wrote to me last year on the subject of 5-in. gauge locomotives, were a number who preferred a medium-sized tank engine; not an elaborate job, but something that was a kind of "cut above" the ubiquitous four-wheeled side- or saddle-tank, and not a complicated box of tricks like a full-blown suburban passenger tank engine, or a heavy short-haul goods engine. The call was for something simple, not too expensive, not too heavy, and as easy to build as "Juliet." I noted the kind of engine desired, and intended to scheme one out, as a sort of interlude in the description of the "Maid" and the "Minx." Well, you all know the saying about a certain party reputed to be adorned with horns and a tail, looking after his especial favourites; and just when I was wondering how on earth I was going to find time for the job, along comes a cardboard tube from a local friend, Mr. C. T. Truett, containing the exact thing needed! Boy—was I thankful? Our good friend has not only saved your humble servant another strain on a nearly-worn-out noddle, but has done the above-mentioned readers a very good turn indeed.

The Germ of the Idea

In his covering letter, Mr. Truett says that in his experience, which now covers some fifteen years of locomotive building (he has been building houses longer than that, being a partner in a well-known, old-established firm of building contractors), a small type of locomotive in 5-in. gauge is far preferable for hard work on a back-garden line, than a more elaborate $3\frac{1}{2}$-in. gauge engine; also much better from the builder's point of view. Back in 1937, he commenced his third engine, a four-cylinder job similar to Mr. Josslin's "Uranus," and the job was carried on until the war broke out, when it was laid up "for the duration." At the end of the era of bloodshed and destruction, work was restarted; but on such a complicated job, progress was naturally slow, and our friend began to wonder when he would finish it. Just at this time, the notes on Mr. Jack Cox's "Tailwagger" appeared, and that put ideas into our friend's head; so after a "board meeting" of the firm of Truett & Son, locomotive builders (the son is 13 years of age and pretty keen), it was decided to cease operations, for the time being, on the big job, and make a concerted attack on a 5-in. gauge engine which could be built easily and quickly, and put into service. An 0-6-0 with outside cylinders and valve gear similar to the L.M.S. "2F" dock shunting engines, was decided upon; the "senior partner" who is also chief draughtsman, got busy with his pencil, and the result you see in the reproduced drawings and photographs. The engine is now in a much more advanced state than shown in the pictures. I might add that the original drawings were just pencilled hieroglyphics on a scribbling-pad; Mr. Truett, like your humble servant, can get along all right without proper drawings when he knows what he requires. The reproduced drawings were made for the benefit of followers of our craft who might wish to build a similar engine, and was a kindly thought on the part of our good friend.

Although the engine is six-coupled, she is only 2 in. longer than Mr. Cox's four-wheeler,

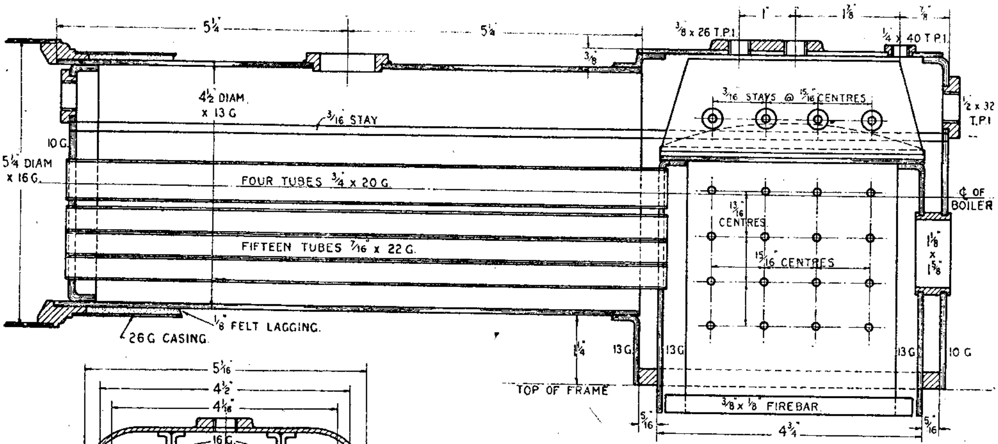


Mr. Truett's 5-in. gauge L.M.S. "2F"

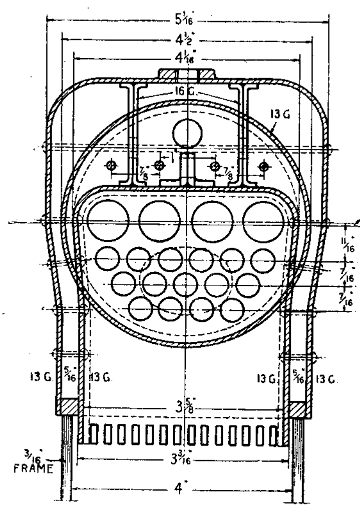
Drawn by] [L. T. Truett

The frames are $\frac{3}{16}$-in. steel; this thickness was decided on, as Mr. Truett had some of that gauge in stock. The axleboxes are cast-iron. The six-coupled wheels are 4 in. diameter, spaced at $4\frac{3}{4}$ in. centres, to enable the engine to take any curve which could be negotiated by the $3\frac{1}{2}$-in. gauge engine of ordinary type. The cylinders are $1\frac{1}{4}$ in. bore and $1\frac{3}{4}$ in. stroke; these may seem small compared with the "Maid" and the "Minx," but the engine is only a very small

The boiler follows the principles so long advocated in these notes. The barrel is made from a piece of $4\frac{1}{2}$-in. diameter by 13-gauge copper tube attached to a Belpaire wrapper of the same thickness, the throatplate being also of 13-gauge copper, and the backhead 10-gauge. The firebox is 13-gauge copper throughout, with double girders at each side, plus a central arched girder, for supporting both crown-sheet and wrapper. Note: Mr. Truett has shown the flanges of the



Longitudinal section of boiler



Cross section at firebox

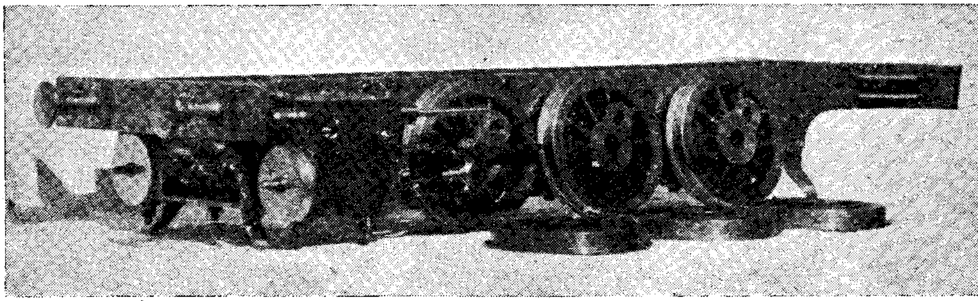
type of shunting tank, and the cylinders are quite proportionate. Mr. Truett had his cylinders cast in bronze, and lapped the bores to get an accurate and smooth finish. Ordinary flat slide-valves are used, on top of the cylinders, and they are actuated by a simple and sturdy Walschaerts gear. The link-trunnions are carried in brackets attached to the guide-yokes, and the radius-rods are lifted and lowered by arms and links similar to Southern Railway practice. Lubrication is attended to by a mechanical lubricator on the left-hand running-board, the ratchet-lever of which is actuated by the top of the combination lever. The connecting- and coupling-rods are very stout, with ample bearing surface, and will stand plenty of "rough-housing" without being any the worse for it.

side girders too narrow; they should be as wide as those shown on the central girder. The side stays in the firebox are shown as plain rivets; these should be $\frac{3}{16}$-in. by 40 screwed copper stays, which may be riveted over both inside and out, if the builders can manipulate a riveting hammer inside the firebox. Otherwise, they should be riveted over on the outside, and lock-nutted on the inside, as per my usual specification.

The barrel contains four $\frac{3}{4}$-in. by 20-gauge superheater flues, and fifteen $\frac{7}{16}$-in. by 22 gauge tubes, laid out symmetrically as shown in the cross-section. The firehole ring is the usual Briggs pattern. Our worthy friend has shown the usual dome-bush, and a double-holed oval pad for the safety-valves; but those shown for the regulator and superheater are not essential, as the $\frac{1}{8}$-in. plate (10-gauge) used for backhead and smokebox tubeplate, affords sufficient depth of thread to allow these fittings to screw direct into tapped holes in the plate. The water-gauge columns, and other backhead adornments, may also be screwed into tapped holes direct. A couple of washout plugs should be fitted in the backhead at each side, just above the foundation-ring, and a blowdown valve in the middle. The firebars are shown as $\frac{3}{8}$-in. by $\frac{1}{8}$-in. strips; but at long last, one of our advertisers (Dick Simmonds) is supplying complete grates with cast-iron firebars. As old "Ayesha" has burnt out nine complete sets of "cut" firebars in her 26 years of active service, I am trying a cast set in her firebox as soon as the present bars need renewal (very soon!) and shall also fit a cast set to "Grosvenor."

The boiler is pitched fairly high, with the

foundation ring resting on the frames, which is a good wheeze. The smokebox is also made from tube, $5\frac{1}{4}$ in. diameter, attached to the barrel by a stepped ring something like a cornice-moulding in section, which has provision for attaching also, a cleading-sheet of 26-gauge sheet metal; felt lagging $\frac{1}{8}$ in. thick, is interposed between this cleading and the actual barrel, so the boiler won't have much chance of catching a dose of 'flu if the engine ever performs in the rain, like its big sisters, and the little engines working the Polar Route. Incidentally, some of my neighbours reckon I am plumb crazy, if it comes on to rain when I am running an engine, and she keeps on running, despite the wet; but it gives me satisfaction to know that my engines *can* run, and keep on running, in any kind of weather, same as their full-sized relations. "Jeanie Deans" had her very first run in rain and wind, and finished up exactly as her big sister used to, coming into Euston on a wet night, well splashed right up to the top of the chimney. By the way, it is curious how engines and crews both have their special characteristics. Some enginemen keep fairly clean on the footplate, whilst others get as black as the ace of spades; personally, I never got beyond the "grubby" stage. The old North Western engines, in wet weather, used to collect generous samples of every county they passed through; and arrived at their destination, to use the expression of the cleaner boys, "well collared up." On the other hand, the Great Western engines never seemed to worry about bad weather at all; I've seen one come into Paddington after running nonstop from Newton Abbot, through heavy continuous rain, and beyond a few splashes, she didn't appear any the worse for it. The cleaners kept them well tallowed, which accounts for some of the milk in the coconut; the Nor' West boys simply used oily "patches" (handfuls of waste) and wiped all the oil off. Our engines on the old "Brighton" kept fairly clean, whether tallowed or not. In passing, I wish my old gasoline cart would follow the example of the G.W.R. in wet weather! Just recently, I had occasion to visit Ashford, and it started to rain on the down journey. The rain didn't persist, but it made the road pretty wet and sticky; and by the time I got home, about half the county of Kent had decided to move into Surrey and had used the car for that purpose. It took me $1\frac{1}{2}$ hours' hard labour to wash it off next day—I can't bear to drive a dirty engine!



The "2F" partly erected

Returning to the boiler of Mr. Truett's locomotive, the smokebox is mounted on a saddle in the usual way, and has a pressed-in front ring, with dished door and dart-and-crossbar fastening. The chimney shown, is on the small side; it would be better if it were made at least $1\frac{1}{4}$ in. diameter instead of the size shown, which is only $\frac{1}{16}$ in. fatter than the Stroudley chimney on my "Grosvenor" ($3\frac{1}{2}$-in. gauge). Old man Billy knew the value of having adequate chimney area, and struck the happy medium between the attenuated—though withal shapely and graceful—chimneys of Beyer-Peacock's early days, and the hideous excrescences disfiguring the smokeboxes of the Southern "Lord Nelsons" and some of the "Schools." It is futile to point out that such things are necessary for efficient working, for the simple reason that my "Tugboat Annie" has a Lemaitre blastpipe and chimney of precisely similar proportionate dimensions, and it doesn't disfigure the smokebox at all. All I did was to dispense altogether with the outer casing. The liner projects through the top of the smokebox for less than $\frac{1}{4}$ in., has a $\frac{1}{4}$-in. wide flange around the bottom, and a ring of 3/32-in. half-round wire around the top. The whole issue was Sifbronzed, and as a tiny fillet was left at the joints between liner, flange, and beading, the result was not only quite pleasing, but entirely disguises the fact that the chimney is no less than $1\frac{1}{8}$ in. diameter on a $2\frac{1}{2}$-in. gauge engine. The free exit for the products of combustion contributes in no small measure to the way the boiler steams.

The superstructure of Mr. Truett's engine is nicely proportioned, the cut-away part of the side tanks rendering the "underneath" more accessible, in addition to providing clearance for the reversing-shaft; whilst the hopper bunker allows the frame to be kept as short as possible. For driving from a flat car behind the engine, the back of the cab, and the roof, can be made readily detachable. The removable part of the back should be as deep as possible, for easy access to the firehole without spilling the contents of the fireman's shovel. There is no need to carry any coal in the bunker, as a box of black diamonds can be perched on the leading end of the driving car, and are nice and handy for firing.

(*Continued on next page*)

Hints on Driving Large-Scale Locomotives

by A. J. Maxwell

NOW that "L.B.S.C." has introduced the 5-in. gauge miniature locomotive to many who, in all probability, have never handled these powerful engines and heavy trucks, may I, as a 5-in. gauge locomotive driver of much experience, offer a word of counsel? A 5-in. gauge locomotive is definitely a small power unit and, as such, reasonable care is necessary, or serious accidents may result.

Many people seem to think that anything is good enough in the way of couplings—I have seen dresser hooks and screw-eyes screwed into the truck buffer planks, chains of various light and unsuitable patterns and materials, S-hooks bent up out of fence wire, and even stout cord used amongst many dangerous devices and sloppy practices.

If a 5-in. gauge locomotive breaks away with a full head of steam and the regulator well open, her acceleration has to be seen to be believed, and she will strike a devastating blow to anything in her path and in the case of several locomotives running on a continuous passenger track she may well demolish the last vehicle of the train in front and severely injure passengers.

Couplings should therefore be soundly constructed of good materials and no chances be given for a breakaway to occur. This is most important.

Tender-pins should be of the French-pin type that lock with half a turn and cannot work out.

A couple of small sandbags are a safe precaution on continuous tracks—one always to hand at the loading point which can be placed on the track to arrest a runaway and save injury to passengers or onlookers and serious damage to the engine.

Never run right on the tail of the train in front, but keep a safe distance between trains to allow for an emergency stop in case of failure or derailment.

If the driver in front goes short of steam or water, do not attempt to run on to his tail and push him into the locomotive depot until he has come to a stand.

If he then intimates that he requires assistance, bring your engine carefully on to the rear of his train and give two "Crow" whistles, which he should answer by repetition before you push him ahead at reduced speed and watching for any hand signal he may make.

Stop and start carefully at all times to avoid snatching and straining the couplings.

Always sound the whistle before moving any engine in steam (Board of Trade rules). Watch your cylinder lubricator carefully and don't let it cease feeding and oil your engine round thoroughly every half-hour when working hard.

Blow down the boiler frequently after dropping the fire—you should bring the engine in with a boiler of water and blowing off when you are going to blow her down so as to shift the dirt from the waterways and foundation ring.

Clear the boiler out occasionally with diluted "Clensol" boiler fluid (for non-ferrous boilers) and wash out well after with clear, cold water.

"Clensol" is also excellent for clearing little injectors.

Be careful to follow the makers' instructions.

Fire a level fire if hard coal or anthracite is used; but if you can get "Betteshanger Kent," coal or good "South Wales" coal, which are far the best fuels, pile the fire high through the middle of the firebox in a G.W.R. "Haycock" fire and you will get bags of steam to play with.

This fire is worked by the S.M. & E.E. drivers at model engineer and model railway exhibitions, and also for continuous runs, and its success has been well proved.

We used it with unfailing success on the $10\frac{1}{4}$-in. gauge engines of the Surrey Border & Camberley Railway.

A whistle code saves much delay and shouting. A suitable code is given below.

Engine ready to come on	4 long.
" " " " off	5 long.
Driver wants coal ..	1 Crow and 1 short.
" " water ..	3 short and 1 Crow.
" " assistance ..	1 Crow.
To call chief track steward	A series of "Pop" whistles.
Signal is not working ..	3, pause, 3, pause, 3.
In case of fire	1 Crow, 1 long and 1 Crow.

"L.B.S.C."

(Continued from previous page)

For boiler feeds, which Mr. Truett has not shown, I should recommend an eccentric-driven pump, $\frac{1}{2}$-in. bore and about $\frac{5}{8}$ in. stroke, between the leading and driving axles, the eccentric being on the latter. Delivery could be made through a clack on the boiler-barrel between the smokebox and the first boiler band. A similar clack on the opposite side, could take the delivery from an emergency hand-pump located in the tank and operated through the filler hole (if ever needed!) same as specified for "P. V. Baker." An injector, similar to that described for "Petrolea" or "Hielan' Lassie," could be located behind the step on the left-hand side, taking water from the tank almost directly above, and delivering into a clack halfway up the backhead, thus keeping the pipe-lengths down to the absolute minimum. The reversing-lever should be set well back, to avoid contact between the driver's fingers and the hot backhead.

Just a final word; any reader who takes a fancy to the engine, and wants to build her, should not take all the details as shown in the drawing, too literally. For example, the expansion-link is shown with a slot only $\frac{1}{8}$ in. wide. As the overall width of the link is $\frac{1}{2}$ in., the slot should be at least $\frac{1}{4}$ in. wide, and furnished with the usual dieblock. Anyway, taking the design "by and large," she is a nice-looking engine and should give her designer and builder every satisfaction.

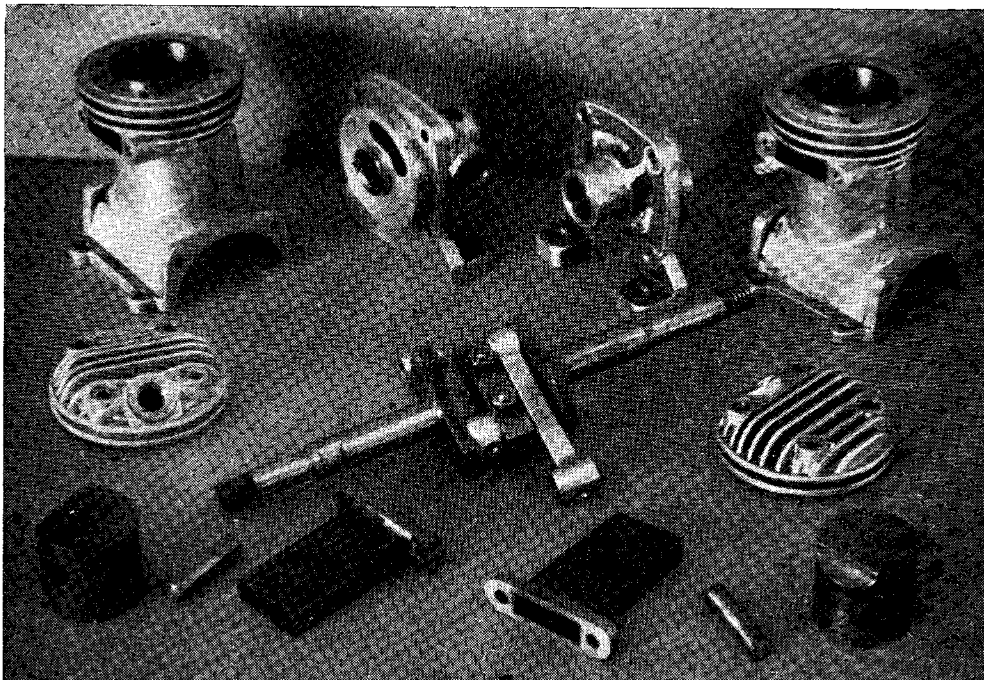
PETROL ENGINE TOPICS

*A 10-c.c. Flat Twin Two-Stroke Engine

by Edgar T. Westbury

ALTHOUGH many of the machining operations on this engine are similar to those which have been described for previous engines, and therefore do not call for detailed explanation, others may present new problems to the inexperienced constructor, and there are also one or two points where special care is needed to avoid possible inaccuracy. Some of my readers who have plenty of experience in machine shop procedure may be inclined to think that I spend too much time on elementary details of setting up, but I know from previous experience that a brief or incomplete explanation of these operations will result either in a shoal of queries from novices who find themselves in difficulties, or unsatisfactory results by constructors who have carried out the work by the wrong methods. The latter are, of course, always with us, and there are always readers who know, or perhaps only think they know, how to do the job better than I do; but while I cannot prevent them getting into trouble, I can at least help the beginner who doesn't know but is willing to learn, by describing methods which I have ascertained to be capable of producing satisfactory results—even though they may not conform to the best or most up-to-date tool room practice.

In the machining of the body castings (Fig. 2), one of the most essential factors is that they should correspond exactly in all vital dimensions. These castings, produced from precision metal moulds, are of quite outstanding quality, not only in respect of detail and finish, but also in accuracy, a very important point when marking-out or setting-up. The first essential operation is the boring of the cylinder barrel, which is most conveniently carried out by mounting the casting on the faceplate, by clamps over the flanges of the joint face. It is necessary first to see that this face is reasonably flat, so that it rests on the faceplate without rocking, and that no flashes or other projections exist on the joint face to cause the flanges to lie out of parallel with the faceplate. In some cases it may be desirable to file or scrape the faces or to carry out a light



The main components of the Craftsman Twin 10-c.c. engine

**Continued from page 137, " M.E.," February 5, 1948.*

facing operation, with the casting held over the cylinder fins in the four-jaw chuck; but apart from getting the flanges true and parallel, it is best not to attempt machining them to finished dimensions at this stage.

When the casting is mounted on the faceplate, it should be set to run truly over the cylinder fins—again, beware of any projecting flashes on the latter—and bored out with a stiff boring tool to the finished dimension (27/32 in.) to take the liner. It should be remembered that in linered cylinders, the general machining of the bore of the housing should be carried out just as carefully as if it were the cylinder surface, in order that the liner, when fitted, shall make perfect contact at all points, without introducing local stresses tending to cause distortion.

It is impracticable to use a reamer or floating cutter to finish an interrupted bore, as in this case, but if there is any doubt of the accuracy, or uniformity of size, in the bores of the two castings, light and discreet lapping will correct it. The castings are then mounted on a mandrel, and both the cylinder-head and joint face finished to correct dimensions. Check the distance of the head joint from the exhaust port to ensure that the port in the liner will match up with the latter. When the two castings are finished, they should be placed side by side on a surface plate, or other flat surface, and a straight-edge laid along the cylinder joint faces to verify that they are exactly the same height.

Next drill the bolt-holes in the crankcase joint flanges, and secure them together for boring the barrel and facing the two ends. If it is proposed to use any form of jointing material between the flange faces, it should be put in now, but personally I prefer to make metal-to-metal joints throughout, and if this procedure is adopted, it is best to lap the flange faces on a flat piece of

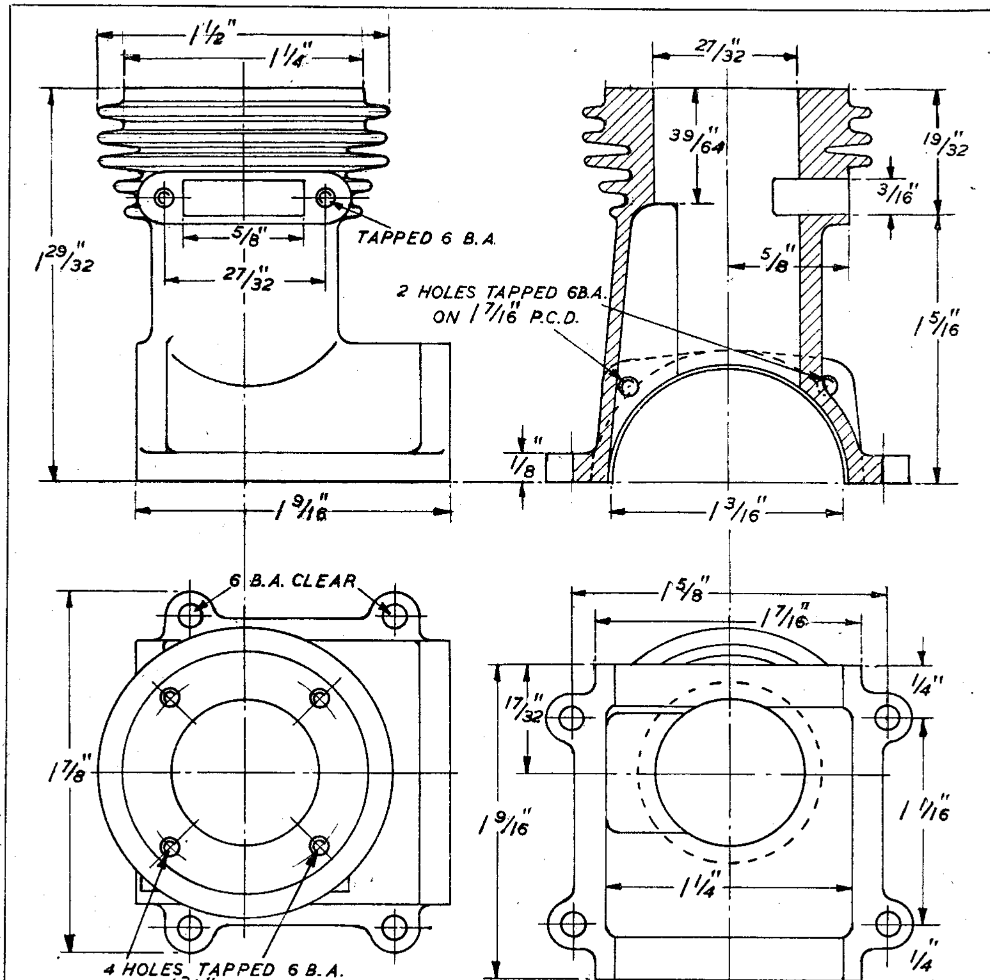


Fig. 2. Details of half-body casting

plate-glass before bolting the halves together. If desired, the holes in one half-body may be tapped, so that screws instead of bolts can be used for holding them together.

The complete assembly is now set up crosswise for machining. There are many ways of setting up, and all of them are satisfactory if the requisite accuracy can be assured; but ordinary methods of chucking leave much to be desired in obtaining and checking accuracy. In production practice, it would be best to machine the halves separately, by bolting them to a jig having locating faces for the crank-case joint flanges exactly on the centre-line of the faceplate, and dead square with it. But for a one-off job, the construction of such an elaborate jig is not justified, and a satisfactory substitute is the clamping of the assembly between angle brackets, as shown in Fig. 3. It will be seen that this set-up can be accommodated on a faceplate no larger than 6 in. diameter. The angle brackets may be made from $2\frac{1}{2}$ in. lengths of 2-in. × 1-in. angle-iron, or if this is not available, it is quite in order to use bent pieces of plate not less than $\frac{1}{8}$ in. thick; but in any case the exact squareness of the essential faces is (*Continued on page* 200)

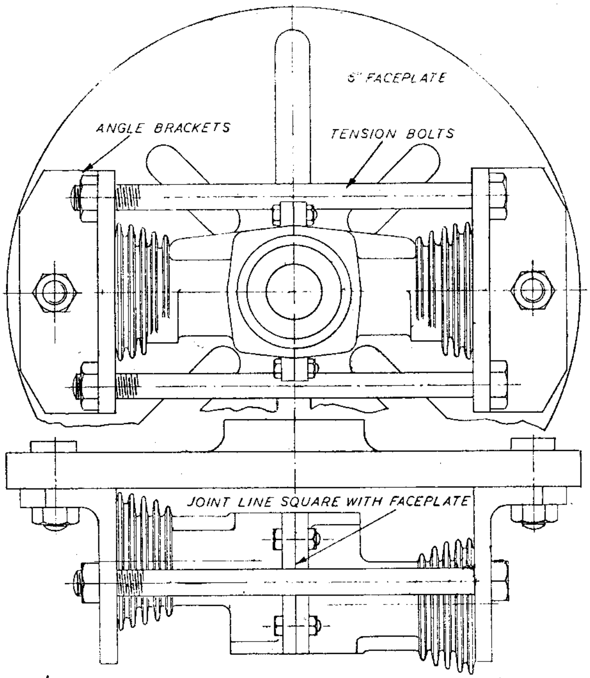
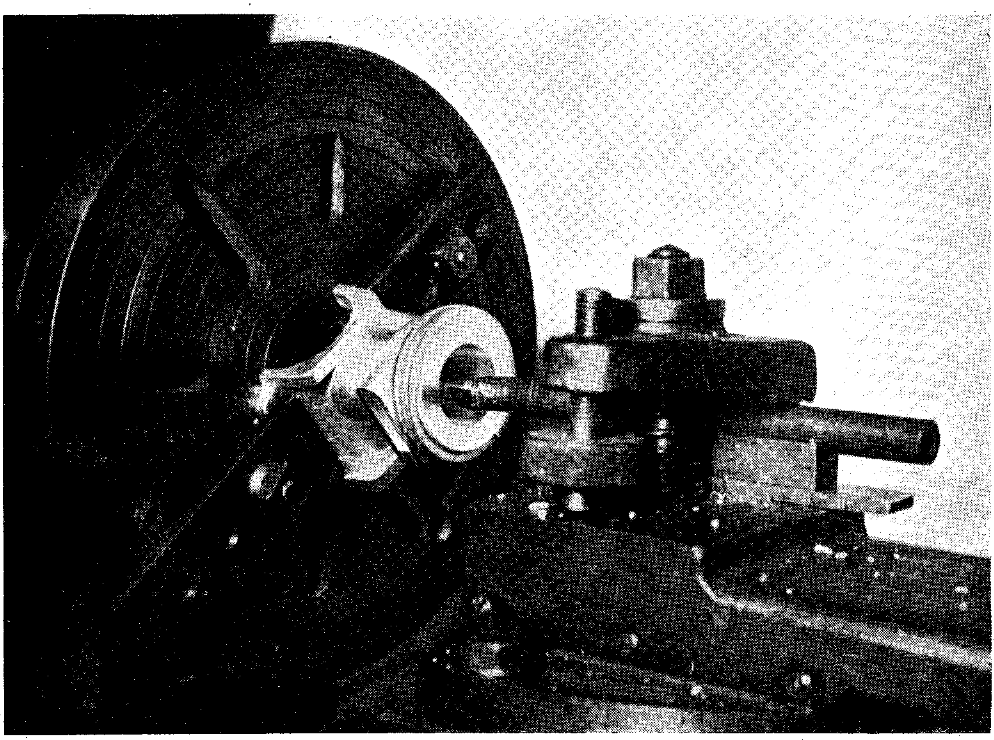


Fig. 3. *Elevation and plan, showing how the body assembly can be machined on a faceplate of limited dimensions*



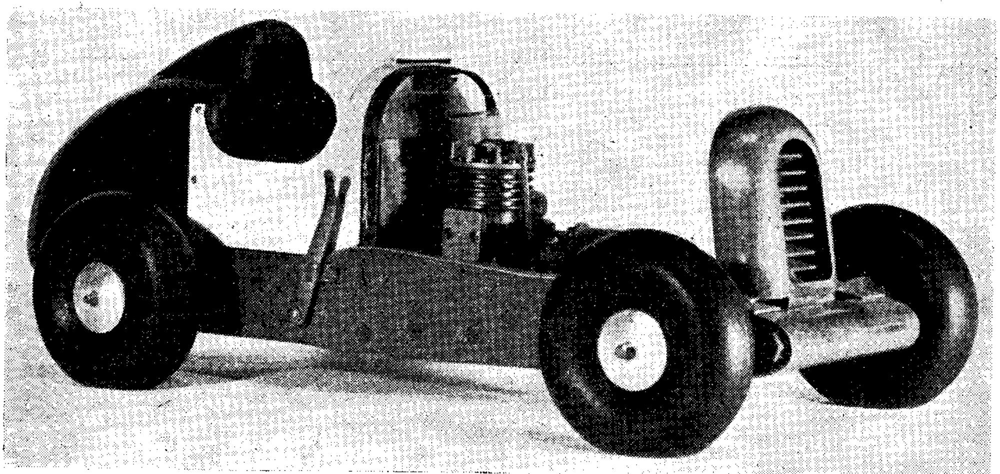
Boring the cylinder liner seating in the half-body casting

A Tyneside Exhibition

THE members of the Tyneside Society of Model and Experimental Engineers are to be congratulated upon their Exhibition, which enabled them to make a handsome donation to the Newcastle *Evening Chronicle* Sunshine Fund.

Owing to its success and widespread appeal, it was decided to run the Exhibition for a second week, and attendance during this extended period given, imposing a heavy strain on the vocal capacity of the commentator.

The Society claim that the 2-mm. scale electrically-driven Pacific locomotive which was demonstrated, hauling four corridor coaches, is the smallest working locomotive in the world, and during the second week a 2½-in. gauge 2-8-0 locomotive also proved a great attraction.

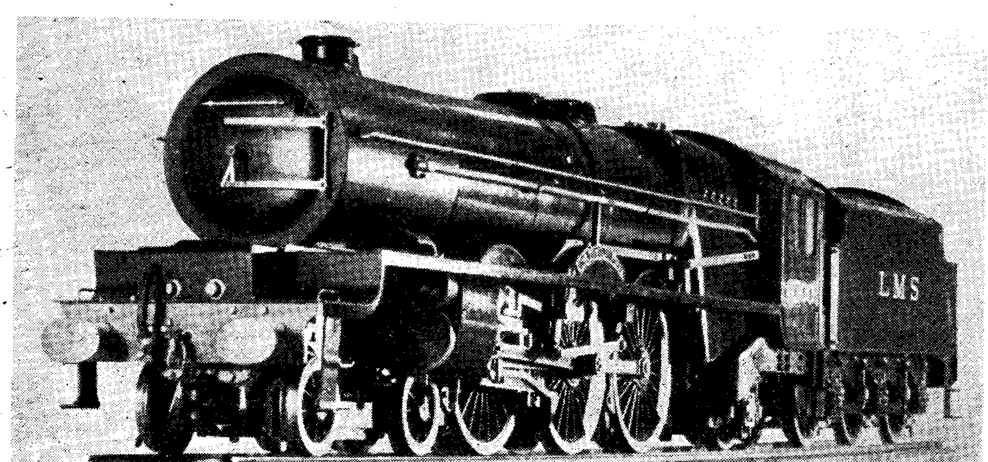


A model racing car (under construction) by R. W. Buck

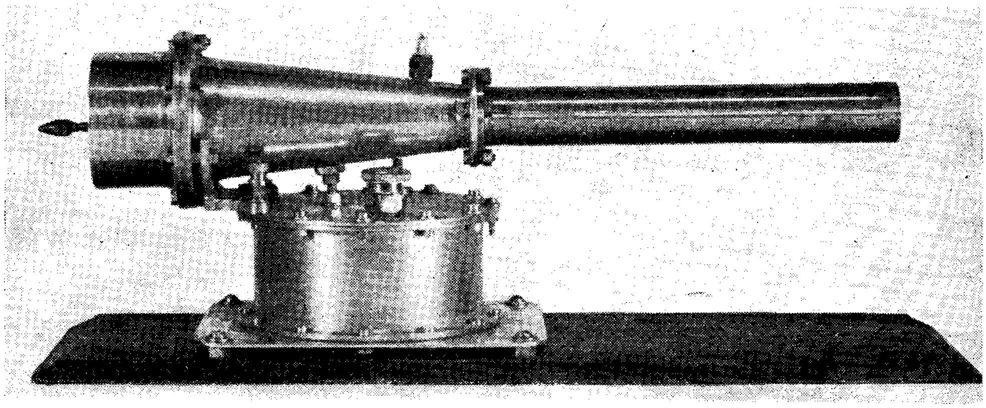
fully justified the decision. A very popular feature was a film show in the annexe to the hall, using 8-mm. films, taken by members, of power-boat regattas, live-steam locomotives hauling passengers and a live-steam garden railway, also scenes on the Romney, Hythe and Dymchurch Railway. Two shows a night were planned, each of 20 minutes' duration, but the popularity of this feature resulted in four shows a night being

A most unusual, but none the less fascinating, exhibit was a Creed type machine, kindly loaned by the Newcastle *Chronicle*, where the latest news flashes could be seen.

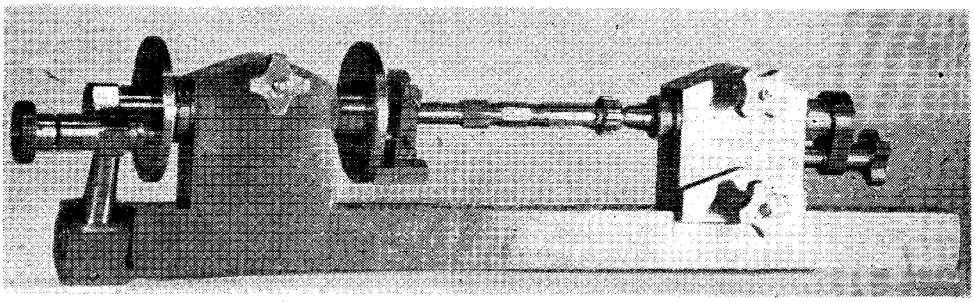
A few representative pictures from the fine selection of models to be seen are published herewith. It is to be noted that an up-to-the-minute prime mover is in course of development in the shape of the jet propulsion unit illustrated.



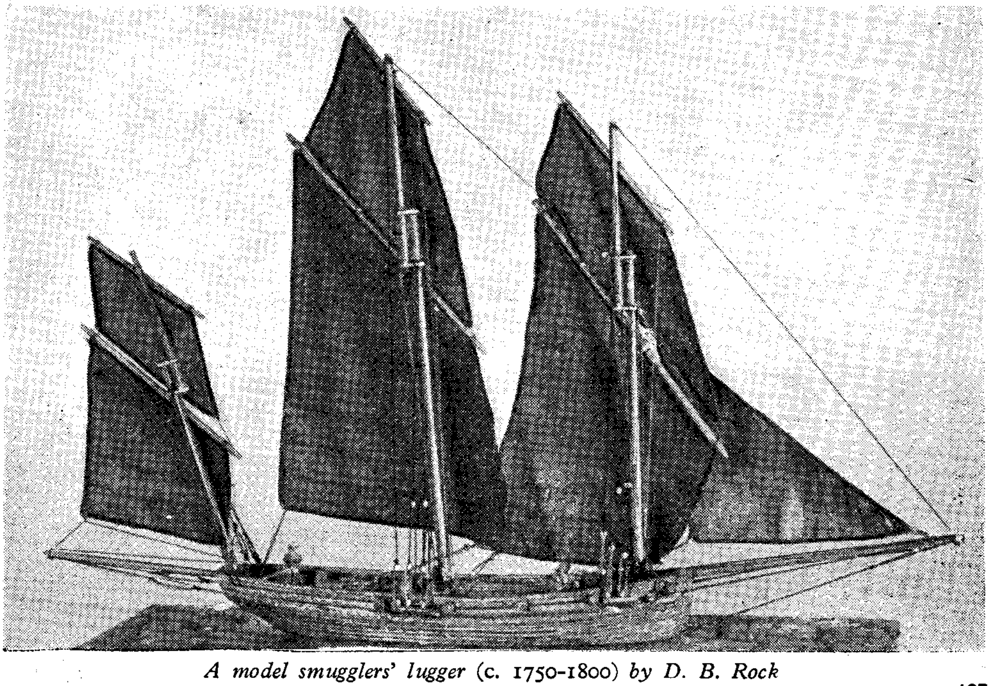
A 3½ in. gauge " Princess Royal " " live steam " locomotive by H. W. Davis



An experimental jet-propulsion unit by D. Brown



Direct dividing centres for use with vertical slide or lathe boring table by L. Dobbin



A model smugglers' lugger (c. 1750-1800) *by D. B. Rock*

Notes on Jet Engines

by "Arty"

PHOTOGRAPHS have recently been published in THE MODEL ENGINEER and elsewhere depicting American jet units. Fortunately, some information on these delightful devices is now available which, as "L.B.S.C." would say, "K.B.P." permitting, I will endeavour to summarise.

Commercial production in America is, so far, restricted to two companies manufacturing what are known as the "Minijet" and "Dynajet." The former was first in the field but the latter now seem to be more profuse. The first "Dynajet" gave $3\frac{1}{2}$ lb. thrust for 16 oz. weight but the latest, the "Redhead Dynajet," gives $4\frac{1}{4}$ lb. thrust. The operating principles are similar to those of the V.1 "Doodle-bug"; indeed, bearing in mind the change of scale, surprisingly similar.

The air entering the unit, Fig. 1, sucks up fuel from the fuel jet which acts as a simple and fairly efficient "atomiser" in a similar fashion to scent and insecticide sprayers. The air-fuel mixture enters the combustion chamber via the holes in the bulkhead, Fig. 2, and ignites, the resulting expansion of gas closing the flap-valve, Fig. 3, and reacting on the bulkhead to provide the thrust. The exhaust gases depart up the exhaust pipe, which pressure wave is followed by a rarefaction "wave." This opens the flaps to suck in another charge which ignites and the cycle repeats itself. The frequency of the cycle, assuming suitable flap-valves, is dependent on the length of the exhaust pipe and some notes on "tuning" these pipes follow later. From this description perhaps it is not obvious how the charge is ignited? This is quite automatic when the unit is running, as the whole device gets red-hot!

Starting the unit is facilitated if it is undertaken as a "combined operation." A cycle or car foot-pump is employed to drive air through the air jet; this sucks up some fuel which entering the combustion chamber is ignited by a spark at the sparking-plug produced by a hand-operated magneto, or by means of a trembler coil.

The process then follows through quite automatically as described in the previous paragraph, and once the engine is running, the lead may be detached from the sparking-plug.

Normal construction is a light alloy nose-piece (up to the bulkhead, that is), finned on the outside and screwed into the welded steel combustion chamber and exhaust pipe. The flap-valve is made of light spring steel.

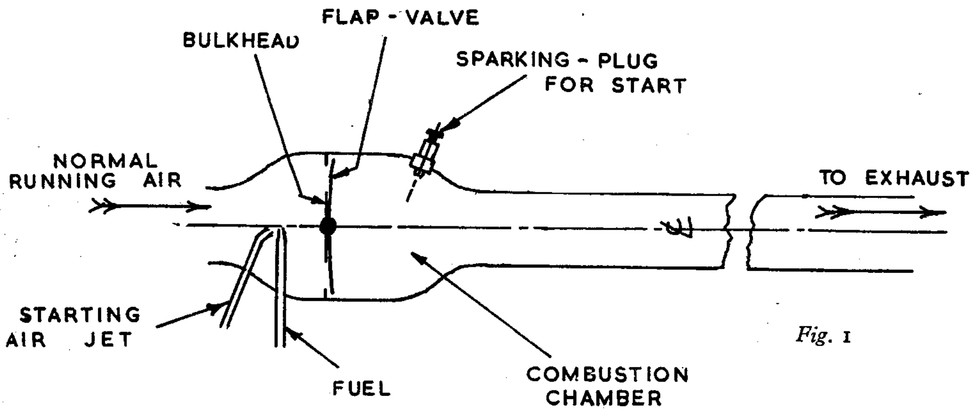


Fig. 1

The present design, while offering a lot of power for comparatively little weight and no torque, has some, so to speak, secondary disadvantages :—

1. The whole tube runs red-hot. This, naturally, may prove awkward so far as incorporating the unit in the model is concerned! External mounting would seem essential and possibly also protective shields. Also, of course, this flying blowlamp is hardly a parlour demonstration model! As far as model aircraft are concerned, the possibilities of a specimen running amuck are a bit lurid, especially in dry weather.
2. Somewhat noisy. This is an understatement!
3. Fuel consumption is higher than an orthodox reciprocating engine of equivalent power.

Some notes on "tuning" of exhaust pipes may be of interest to anybody contemplating the construction of this type of unit. A column of air possesses certain natural frequencies and, if agitated at one of these frequencies, some parts of the column will pulsate up and down. Considering a pipe open at both ends, the air can move freely at either end while, in the simplest case, the air in the middle remains at rest; that is, in the centre, the pressure variations are at a maximum while at the ends the pressure variations are at a minimum (because the pressure differences cannot build up as they are equalised by the outside air). This is depicted in Fig. 4A where the pressure variations are shown by

horizontal lines and displacement variations by vertical arrows. That is, when an open pipe is giving its fundamental, a "node" or position of minimum motion and maximum pressure variation is formed at the middle and "anti-nodes" or positions of maximum motion and minimum pressure variations at the ends. A pipe can also give "overtones," the air column then dividing up into nodes and anti-nodes (Figs. 4B and 4C).

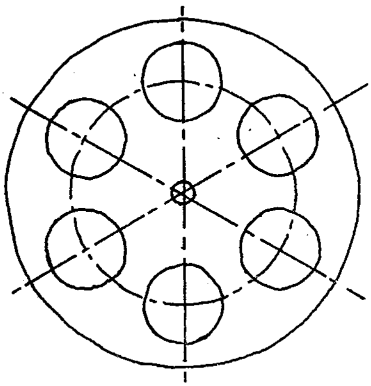


Fig. 2. Bulkhead

When a pipe is closed at one end, as on a jet unit of the type under discussion, this end is always a node and the open end is always an anti-node. Fig. 5A shows the conditions when the pipe is giving its fundamental and Figs. 5B and 5C its first and second overtones respectively. It can be seen that the fundamental of a closed pipe is the same as that of an open pipe of twice the length.

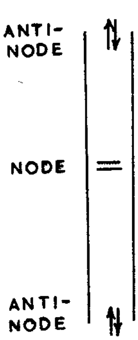


Fig. 4A

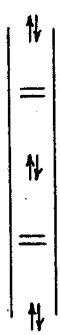


Fig. 4B

Fig. 4C

Fig. 5A

Fig. 5B

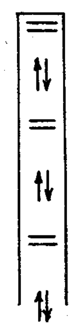


Fig. 5C

Fortunately, the relationship between the length of pipe and its frequency is quite simple.

If f is the frequency (per sec.)

w is the wavelength (feet)

and c is the velocity of propagation of the working medium (ft./sec.),

then $c = fw$.

The wavelength of the fundamental of a closed pipe is equal to four times the pipe length (actual length plus 3/5th of the radius for "end correction"), while that of an open pipe is twice. The velocity of propagation will depend on the gas and its temperature. If we assume air, then the velocity is given by

$$1086\sqrt{1 + 0.004t} \quad \text{ft./sec.}$$

where t is the temperature in degrees Centigrade.

It can be seen that the frequency is inversely proportional to the length of the pipe, the practical result of which is the well-known fact that "tuning" the exhaust pipe is done by altering its length. In the case of our jet unit, this would have the object of making the frequency suitable for the shuuter or flap; that is, so that it doesn't have to operate too slow or too fast. This is a matter entirely dependent on each design and is naturally best determined by actual experiment. A source of error on the theoretical side is that the combustion may be of the nature of an explosion in which case the velocity of propagation may increase slightly. The formulae given, however, will supply an idea of what length pipe will be necessary for any required shutter speed. Alternatively, if the length of pipe is limited, it will supply the minimum shutter speed allowable.

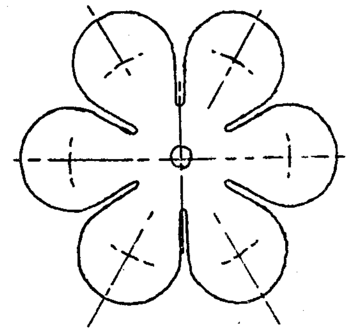


Fig. 3. Flap-valve

It is hoped that these notes will assist any potential constructors of these units and that soon there will be some accounts of practical results in the pages of THE MODEL ENGINEER.

Solder Welding

by "1121"

DURING certain types of work, such as the making of metal patterns for castings, or the fabricating of a dummy "casting" for a show-model, the need is often felt for some material which can be used to produce a "fillet," or even to build up a shallow web or reinstate a sharp corner which has got knocked off, much as the wood-pattern maker can employ putty, or some similar filling. The required material can be found in most workshops, and is known as solder.

Those who have used solder extensively will have observed that when it is gradually heated it passes through a "plastic" state before actually melting and becoming fluid. When in this plastic condition, it can be smeared about, built up into lumps, and generally worked as desired. The art of "plastic welding," therefore, is to maintain the temperature of the job, and the solder being applied to it, at just the required point—no lower, and certainly no higher. When the solder is in this condition, it possesses sufficient tenacity to hold the various parts of the job together, and should it be desired, they can be pushed about until they are in exactly the right position without the whole thing falling to pieces.

For this purpose a soldering-iron is definitely quite unsuitable. The apparatus required is a small blowpipe or blowlamp. The writer uses a "Bladon" blowlamp, burning methylated spirit, which provides a fierce, concentrated flame, with which the heat can be applied just when and where it is required. It will be appreciated that a large spreading flame is less suitable for this work than a "pencil" point, if things are to be kept under control.

The method is to heat up the job with the flame, constantly "trying the heat" with the solder, until it begins to feel soft. The solder is then fed into the corner, or on the surface, as the case may be, and as soon as it begins to show signs of "running away" the flame is removed. By this means the work can be kept at just the right temperature, and the solder applied and worked as desired.

It is necessary that any tools used for directing the solder where it is wanted should be small in section, to prevent their chilling the solder, and the same remark applies to the solder itself. The small-diameter resin-cored solder, sold in reels is best. For most purposes a length of $\frac{1}{8}$-in. diameter brass rod is a suitable tool, but if the need is felt for something of a larger radius, a phosphor-bronze ball of the desired size can be drilled and tapped in the lathe, and screwed tightly on the end of a piece of wire. These tools can be dipped in flux if the solder shows any disinclination to stick where it is wanted, and it will "take" more easily if the parts to be operated on are tinned over before assembling.

For the "building-up" of a sharp corner, the solder is applied in just the same way, the temperature of the job being gradually raised until the "plastic point" is reached, when the solder is fed on to the corner in lumps, and then smoothed down with a flat strip.

Petrol Engine Topics

(*Continued from page* 195)

most important and should be carefully checked. If the faceplate dimensions are limited, and it is "tight" over the bed or gap, it will be necessary to cut the corners off the brackets as shown; or it may be found desirable to turn the flanges of the brackets inwards.

Clamp the assembly lightly between the brackets, using $\frac{1}{4}$-in. tension bolts, and interposing a piece of paper between both contact surfaces; then clamp the brackets lightly to the faceplate, as near central as possible. Set the crankcase joint face dead square with the faceplate, sighting the joint line from the blade of a square held on each side in turn. Set the front crankcase flange face parallel with the faceplate, using a scribing block or depth gauge for this purpose. Next slide the brackets on the faceplate to bring the crankcase barrel exactly central for boring and facing. After taking the first cleaning-up cut through the barrel, ascertain by measuring from the inside of the barrel to the cylinder head, that the two halves are exactly symmetrical. Lack of care in this respect may result in a discrepancy in vital measurements, affecting port timing, etc., even though the halves are exactly the same length from head to joint face.

Having bored the mouth of the barrel to size at both ends (the centre part is relieved and need not be machined), face the front end, and the back face may also be faced at the same setting if a suitable internal back-facing tool is available. Alternatively, the assembly may be mounted on a mandrel for facing the back end. At this state, it should be noted, these terms "back" and "front" are purely arbitrary, until the body is mated with the respective bearing housings; but even these are interchangeable in position, if dimensions and hole locations are accurate.

(*To be continued*)

A Rope-Making Machine

A method of making scale-size rope for ship modellers

by Dr. David Longridge

A ROPE is composed of a certain number of strands (usually three), the strand itself being made up of many yarns. Three strands twisted together or "laid up" form a "hawser-laid rope" (the usual, common type of rope), and three such ropes laid up together make a "cable-laid rope" or "cable." A less common type is the "shroud-laid rope," consisting of four strands laid round a central strand or core. This type was used for shrouds and stays. In practice the prepared fibre is twisted or spun in a right-hand direction to form yarn; the required number of yarns receive a left-hand twist to make a strand; three strands twisted to the right make a hawser or rope; three ropes twisted to the left make a cable. Thus the twist in each successive operation is in a different direction from the preceding. The majority of ropes on a ship were right-handed or "with the sun," although there were some exceptions to this. Cables and shroud-laid ropes, however, were always left-handed.

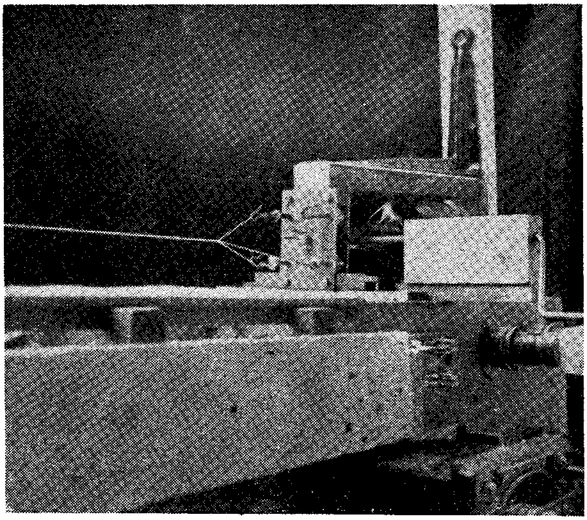


Fig. 1. The headstock, showing the "whirls"

The Principle of Rope Making

This can perhaps be most easily grasped by making the following simple experiment. Stretch a few inches of fine string between the forefinger and thumb of each hand. After twisting the string by rolling it between the finger surfaces, bring the two hands together. A loop, followed by a twisted length, will at once form in the string. Cut off the loop at the end with scissors, and you now have a short length of a sort of "rope." The important feature of this is the absence of any tendency to become untwisted. The reason for this is that while each strand is trying to untwist its torsional energy is converted into mutual friction against its neighbour, and it is this friction which counteracts any tendency to become unravelled. Two further points emerge from this experiment. The first is that if a right-hand rope is to be laid up the strands must be given a left-hand twist, and vice versa. The second is that while the rope is in the process of being laid up it revolves, so that provision must be made for this in rope-making machinery.

The Rope-Making Machine

This machine was based on the ancient, but still greatly used, method of rope-walk spinning, which can be seen in various factories in Bridport, Dorset, and other places. There are three essential parts, known in the trade as the "whirls," the "looper" and the "top."

The whirls, see Fig. 1, are hooks at one end of the ropewalk arranged to revolve in the same direction. Three hooks are generally required, but it is an advantage to have four so that shroud-laid rope can be made. A simple gearbox can be made, using Meccano gear wheels and shafts. These run between two brass faceplates bolted together with wooden spacers. The four driven shafts project through one faceplate for a short distance and then end in wire hooks. It is important that these should be securely fixed to the shafts. The central driving shaft projects through the other faceplate and in its simplest form ends in a crank for hand turning. As a great many turns have to be put into each strand it is advisable to have the whirls geared up to a fairly high pitch in relation to the handle.

The looper, see Fig. 2, is a single hook at the other end of the ropewalk. It must be able to revolve very freely, and, in contrast to the whirls, which are in a fixed position, it must be able to move towards the whirls as the rope shortens during the laying up process. Our first looper was derived from swivels bought from fishing-tackle makers, but a vastly more satisfactory one was a part sold for model aircraft of the elastic-driven type, devised to connect the propeller with the rubber. This is a light hook of just the right size, with a beautifully made miniature ball-bearing. The looper should be fixed to a block of wood which can be dragged up

towards the whirls, more satisfactorily mounted on wheels to reduce friction.

The top, see Fig. 3, is a wooden cone with three equidistant grooves running from the apex to the base. A special top is necessary for shroud-laid rope, with four such grooves. The grooves should be well polished to minimise friction. The top should have a stiff wire inserted near its base to act as a handle.

Materials

We have tried various sizes, shades and brands of sewing cotton, linen thread, silk and button thread, but have come to the conclusion that the most satisfactory material of all is Dewhurst's "Sylko," used in two sizes, 40 and 50. We use two shades, black to represent tarred tope for the standing rigging, and dark beige, which is an excellent colour for the running rigging. With the two sizes a very wide range of sizes of finished rope can be achieved simply by altering the number of yarns forming each strand between the whirls and the looper. Thus a single yarn of "50 Sylko" between each whirl and the looper makes a fine rope, representing a 1½-in. circumference rope in terms of a quarter-inch scale model, while four yarns of "40 Sylko" set up on each whirl will make a larger rope, representing a 6-in. prototype. The main disadvantage of using "Sylko" is due to the fact that the manufacturers lay it up right-handed. When turning it into right-handed rope, the yarns tend to become unravelled to some extent, and the model rope is inclined to be rather fluffy. After various trials we have found that the best method of removing this fluff is by passing the rope fairly rapidly through the flame of a spirit lamp. This type of flame is comparatively cool and does not readily char the rope. The fluffiness is less apparent in the larger sizes of rope and cable.

Method

Having provided yourself with a set of whirls, a movable looper, and a top, select a flat space, such as the top of a table. The whirls are now clamped on at one end, and the looper (fixed to a wheeled block, if you like) is placed at the other end. Tie the end of your thread on to the looper, and, keeping the reel in your hand, pass the thread up to and round one of the whirls and then back to the looper. Here it can be just passed through the hook and so on up to the second whirl, then back and up to the third whirl, ending finally at the looper again, where the thread is cut off and tied. Before tying one should make sure that the tension is the same throughout as far as possible. The best way of doing this is to bring the final yarn down and through the looper, cutting it off about 6 in. above the hook. Tension is now adjusted by pulling or slackening this final yarn with the fingers of one hand; when satisfactory the looper shaft is revolved with the fingers of the other hand, so that the free end of the final yarn is twisted several times round the remaining yarns close to the hook. This maintains even tension throughout while two or three half-hitches are made for final security. You will now have three strands on your whirls, each consisting of two yarns. It is simpler to begin with two yarns, or with multiples of two, for only two knots are then required. With an odd number of yarns, four knots are necessary, and there is greater difficulty in getting the tension even in the three strands as well as extra time being needed to set up the strands. Finally, the top is inserted between the strands close to the looper, so that each strand occupies a groove. (Fig. 2.) The whirls are now revolved so as to impart a left-hand twist in the strands if right-hand tope is to be made, and vice versa. At first there may be some lengthening, especially if "Sylko" is used, owing to a certain amount of unravelling of the yarns. Soon, however, progressive shortening occurs, and the looper is drawn up towards the whirls. This may continue for some time before the rope starts forming, but eventually the looper will begin to revolve, at first in short spasms, and then regularly and rapidly, forming rope between it and the top. (Fig. 3.) As the three strands are blended into the rope the top is steadily pushed up towards the whirls, at which point it is finally extruded. It will probably need a little steadying assistance during its journey unless it is of the improved type described later. When the freshly formed rope is examined it will be noticed that it is rather slackly wound, and it must now be put through a final process of "hardening" to make it more compact. The top is removed and the three strands cut away from the whirls, and then all three tied on to one of the whirls (see Fig. 4). The looper must be prevented from rotating by some method, such as passing a bent length of wire through the hook, and the whirls are now revolved in the reverse direction to that used for laying up the rope. This has the desired effect of hardening the rope, which is also shortened. There is now quite a tendency to untwist and revert to the unhardened state, but this is overcome by stretching the entire length of rope, causing the individual strands to bite into each other. A finishing process of "de-fluffing" with a flame may be given if necessary before the completed rope is wound on to spools. It is as well to have the latter of large diameter, and we have made these easily by tacking squares of cardboard on to short lengths cut from old-fashioned wooden curtain poles. Squares of cardboard are more easily cut than circles and have the additional advantage of preventing the spool from running away as its contents are unwound.

Improvements and Modifications in the Machinery

There are obvious limitations in the simple type of apparatus described above, and our own has gradually developed into a much more complicated machine, though working on the same principles. In our machine the looper is mounted on a "traveller" or wooden carriage. This has four pairs of flanged wheels and runs on a double railway track. For this Gauge "O" Bowman track with wooden sleepers happened to be convenient, and the track was nailed on to two fourteen foot lengths of 3 in. by 2 in. timber separated about a foot apart by wooden spacing boards nailed on underneath. The two beams are arranged on a slightly

inclined plane, and the flat upper surface of the traveller enables different weights to be placed on it so as to vary tension in the strands. A small hinged hasp was screwed on to the back of the traveller and by engaging ratchet fashion in the sleepers as the traveller is pulled up, prevents

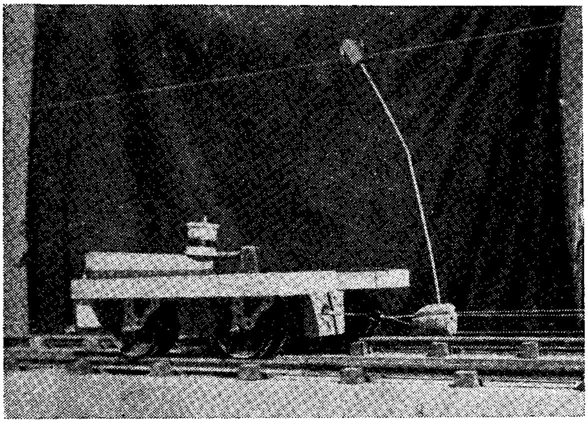


Fig. 2. The "looper" mounted on the travelling carriage

the latter dashing headlong down the track should the rope break. Later this hasp was screwed to a wedge-shaped mounting on the back of the traveller, which allowed the safety device to be disengaged at will. A simple form of stop for the looper was fitted, consisting of a strip of brass soldered on at right-angles to the shaft of the looper. This strip engages with a small door-bolt screwed on to the upper surface of the traveller.

It was soon found that hand-turning of long lengths of rope is a tiring and monotonous task, and so an electric drive was fitted up. At the upper end of the machine a board was nailed between the two tracks and projecting upwards beyond them. On this was mounted the original hand-turned whirls gearbox and a small Whitney Type C4 a.c. electric motor. A brass pin screwed into the shaft of the motor at right-angles engages with the crank handle of the gearbox and acts as a sort of universal joint. A switchboard was arranged below the motor, carrying fuses, mains switch, a reversing switch, a rheostat and two electric light bulb-holders with cut-out switches acting as variable resistances. A further development was a simple form of "remote control" enabling the motor to be stopped or started from any point on the "ropewalk." This is a long loop of cord running over pulleys at each end of the machine and having a clove-hitch round the handle of the rheostat, and it is found to save a great deal of walking up and down. Another more important refinement is the overhead wire arrangement for carrying the tops. A thin wire was stretched tightly between two posts so that it ran down the centre-line about a foot above track level. Each top (it is advisable to have a selection of different sizes) is suspended by a stiff wire from a double-flanged wheel which can run up the wire as the top is forced upwards by the rope in process of formation. (See Fig. 3.) Lightness of structure was aimed at to provide minimum resistance to the top, a point which was of greater importance when making the finest ropes, the strands of which are apt to snap.

Shroud-laid ropes made on this type of machine for shrouds and stays have a most distinctive and pleasing appearance. To make the lower shrouds for the fore and main masts, for example, in a $\frac{1}{4}$ in. scale model 18th century line-of-battle ship, make four separate three-stranded right-handed ropes. Each strand consists of four yarns of black "Sylko 50." Attach one end of each rope to each of the four whirls, and knot the four remaining ends carefully round the looper making sure that tension is the same in each rope. This point is particularly important and the knack of doing this takes a little time to acquire. Insert the four-grooved top and lay up left-handed. Harden in the usual way. For some reason the first and last few inches of these lengths of shroud-laid ropes tend to be a little uneven, and we have found it impossible to overcome this fault, though it does not really

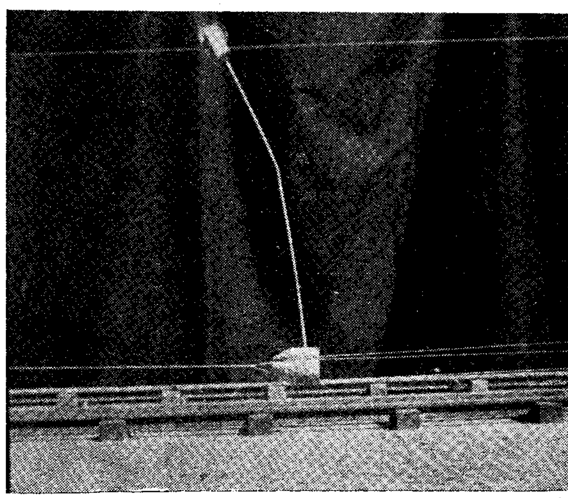


Fig. 3. The "top" freely suspended from the overhead guide

matter, as these sections can be discarded. Another feature is that a considerable torque is developed in the four ropes during shroud making. This may be so great as to stop the electric motor, especially if the whirls are fairly highly geared. This being the case in our machine, a hand-turning arrangement was fitted, consisting merely of a crank driving a crown-wheel meshing with a pinion wheel on the driving shaft of the gearbox. (See Fig. 4.) This crank could be

moved in or out of gear, and it is found to be a great advantage with very large and very small ropes. It should be admitted, of course, that our shroud-laid ropes are not strictly speaking shroud-laid, having no core, but the external effect is the same.

Serving and Worming

The machine can be adapted for these purposes by fitting an additional hook to the driving central shaft of the gearbox. The length of rope to be served is now stretched between this hook and the looper so that when this central hook is rotated, either using the motor or by hand, the length of rope revolves as a whole. There is an old rhyme which tells us to

"Worm and parcel with the lay,
Turn and serve the other way."

Translated in practice, this means that a serving must be applied with the rope revolving in a direction which tends to twist up the strands. In this way a tight serving is rendered even tighter as the rope tends to expand.

Worming was the name given to the process of filling up the spiral grooves in a large rope with smaller ropes or "worms," which prevented wet and rot from getting into the heart of the rope. (See Fig. 5.) It is a difficult process to reproduce in a model, but one which is made considerably easier by this type of rope machine. A good light is essential, and we have found that two strip-lights suspended from the overhead top wire are very satisfactory. In addition, a foot-switch control for the motor is more or less essential, especially if one is single-handed.

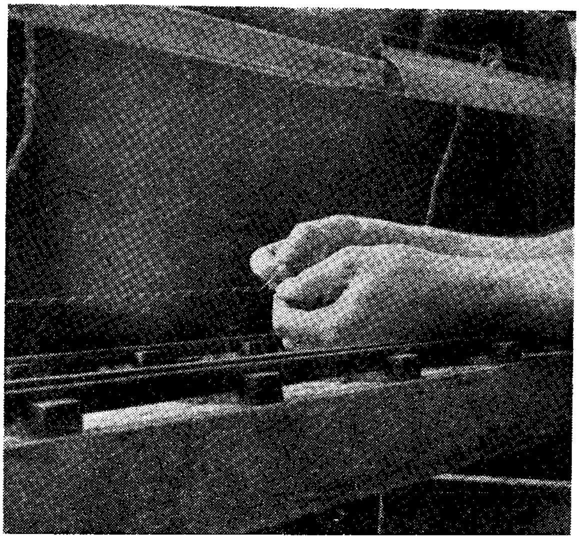


Fig. 5. "Worming" the rope, showing the use of a white thread as a guide

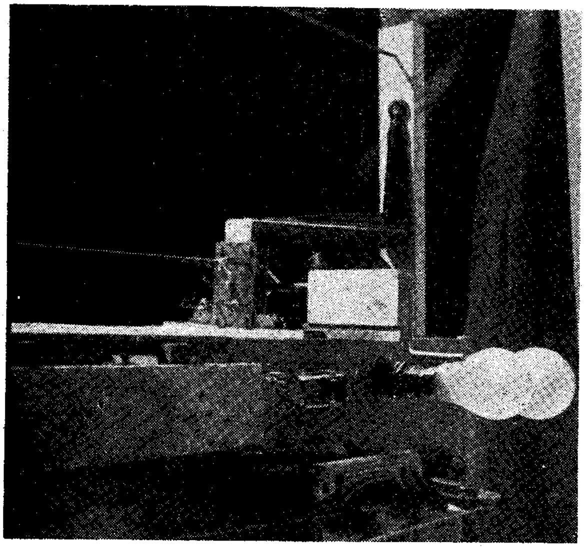


Fig. 4. The rope tied to one of the whirls for the hardening process

Unfortunately most of the ropes which have to be wormed are black, and it is not easy to see, so that mistakes are frequently made, necessitating frequent stoppages. Stretch your length to be wormed between the central hook and the looper, only this time let there be a loop of ordinary string a few inches long interposed between the central hook and the length of rope. This itself gets twisted up, and acts as a sort of reserve of torque. For a shroud-laid rope four worms are required. These are about a quarter as long again as the large rope and are wound on to separate reels for each worm. It is absolutely essential to get your first worm in its right groove all the way down. A slight mistake may be made and will be overlooked until the second worm is laid into the adjacent groove, which means removing both worms and starting again. Consequently it is a very good plan to let your first worm be of thin white cotton rope—this provides marked contrast with the black background and a mistake is seen at once and rectified. When one is satisfied that this worm is lying in its groove throughout the length, it is comparatively simple to follow down this guide with the next three black worms. The white worm is finally removed and replaced by a black one. In the actual application of worms the large rope must be turned in a direction which tends to untwist the strands. If it is turned the other way the worms will be loosened by the final hardening process and will have a most disconcerting habit of getting into the wrong grooves if the rope is handled or bent, and it is practically impossible to get them right

again. In our machine we start at the looper end of the length by knotting the first worm round a strand having first passed it through the rope with a needle. The reel is taken in the palm of the right hand, the forefinger and thumb controlling tension on the worm. The forefinger and thumb of the left hand grasp the unwormed portion of the rope just above the right hand. In this way, using the footswitch, or with an assistant turning by hand, perfect control is maintained as the two hands follow the grooves upwards. We have found it best to lay in the worms by short lengths at a time, for by this method mistakes are less likely to occur. It is important to keep the left hand above the right so that the speed of the revolving rope can be completely controlled. (See Fig. 5.) If a sudden stop is made and the motor continues turning, the loop of string at the upper end takes up the extra twist so that there is no undue strain in the system. When the upper end of the rope is reached the ends of the worms are finished off in the manner of a serving. Finally the wormed length is unhitched from the machine, hardened by twisting it up and stretched. This causes the worms to bite into the grooves in a permanent and most satisfactory way. If, however, the worms have been applied with too much tension, and the hardening process is overdone, they will then bite in so far that they will disappear from view and become embedded in the centre of the rope.

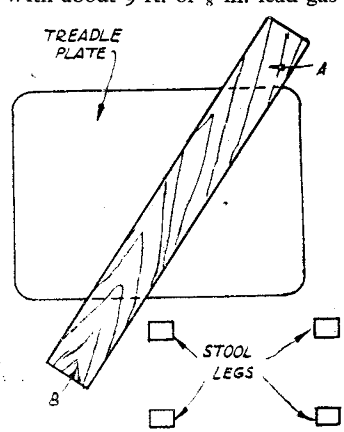
Editor's Correspondence

Treadling

DEAR SIR,—*Re* Mr. Harris's letter on the above subject, I have the following suggestions to offer, based on my own experiences.

I have read several times about people standing treadling a lathe, but it did not occur to me to mention before, that I have always sat treadling my lathe; usually an old stool on end with a cushion on it suffices, the important point being that you should be at a comfortable height, however elaborate.

My lathe-stand is a "Hobbies" frame; I once had designs on an old "Singer" machine table. With about 9 ft. of $\frac{5}{8}$-in. lead gas piping, circled up, then flattened and fitted immediately under the rim of the fly-wheel (which I had found to lack momentum), I had quite a serviceable treadle. My next modification was to fit a board diagonally across the treadle-plate to increase leverage. When working on back gear I find this a great advantage, my right foot pressing at *A*, my left at *B*. If anybody wants tuition, just watch the lady at the sewing machine. I am able to work for three and four hours comfortably; I cycle a lot, so this perhaps helps!



I originally intended fitting a motor, but since carrying out the above, I have not considered it necessary.

I hope this letter will be of assistance.

Yours faithfully,

Edinburgh. CHARLES HUNTER.

DEAR SIR,—I was interested to read K. N. Harris's letter on this subject. I have used the floor stand with advantage; other things that count are the treadle centres.

Treadle-centre to connecting-rod should not be more than three-quarters of connecting-rod to back pivot—9 in. and 12 in. on my lathe ($5\frac{1}{4}$ in. centre) pulley crank, $2\frac{1}{2}$-in. throw, giving about $8\frac{3}{4}$ foot stroke—this I find is the maximum I can do, but is good for heavy work.

A fixed centre connecting-rod is not used, but a chain running over 2-in. diameter rollers on crank and treadle pins—if your foot slips under the treadle no harm is done.

I also use a "back board." Two horizontal wooden supports are attached to either end of the lathe stand, with holes and pegs to locate a board, about 2 ft. 4 in. from centre of lathe, placed behind you after taking your place before the lathe. This forms a good abutment from which one can push harder with less fatigue. I have used a broad strap hooked to the lathe, but prefer the board.

Fine adjustment of bearings, especially thrusts, and the use of thin oil is essential.

The back-board is a very old idea, much used by the old treadle-lathe turners.

Yours faithfully,

Hayes. D. B. GLOYNS.

Road Locomotives

DEAR SIR,—I was very much interested to read Mr. W. J. Hughes's article in THE MODEL ENGINEER for November 20th last on the old Fowler road locomotive "Lord Kitchener."

As I have been an employee of Messrs. Fowler's for a number of years now, and being a keen model engineer also, I take every opportunity of getting into touch with the old hands who are still there and talking about the old products.

I, therefore, showed the article in question to one of our oldest members, Mr. A. Pepper, who is now in his 53rd year with the firm and who actually participated in the tests of these locomotives at Aldershot for the Government for 15 months.

He very kindly gave me an account of these engines, and the facts and figures are from his own personal records; therefore, I can do no better than quote his own words:—

"The engine in question was one of a group of ten, numbered 9289-9298 and delivered between August 20th, 1902 and February 9th, 1903. This group of engines did not go to South Africa, but were used at Aldershot and on Salisbury Plain.

No. 9292 was reboilered by Messrs. John Fowler in December, 1915, for Mr. Hall and repainted in crimson lake and yellow. When the Government received these locomotives they had copper fireboxes with brass 'Serf' tubes, and were fitted up for burning crude oil, using 'Kermode' burners. They had Dewrance water-gauge cocks and Klinger glasses, and the pressure-gauges could be lit up at night by a small lamp inside the gauge.

They were fitted with extra large front tanks, which, with the standard rear tanks, gave a run of 15 to 18 miles. They had a large water lifter with a two-way discharge cock, arranged so that when the tanks were full, water could be diverted into a trailing service tank by a flexible hose.

On the right-hand side was fitted a Worthington steam pump as an auxiliary boiler feed, as well as the engine-driven pump and Holden and Brooke hot-water injector. Ross 'pop' safety valves were used.

The engines were fitted with machine-cut gears throughout and the hind axles were 6½ in. diameter with a 2 in. bore hole right through, made of oil-toughened spun steel by Taylor Bros. of Leeds.

They were the first engines to be fitted with trough slide-bars at the bottom, and a higher than normal steering ratio was used, with double worm and wheel.

These locomotives were too heavy for the roads of this country, and on several the front tanks were removed, and 18-in. wheels instead of 20 in. used, to reduce weight and bring them within the Law, and in this condition were used by the A.S.C. for many years before being sold.

The forward winding drum on the left hind axle was specially made to carry 150 yds. of ⅝ in. diameter flexible wire rope (maximum) and only cleared the flywheel by the proverbial inch.

The flywheel brake was added later by private owners. Starting or auxiliary valve is for admitting live steam to l.p. valve chest when h.p. crank is on a dead centre. What is marked on the photograph 'injector cock' is the top cock of the Dewrance water gauge.

Messrs. Fowler supplied 44 road locomotives and wagons for the Boer War, besides many ploughing engines with winding drums. The road engine had a nominal h.p. of 10 and a continuous rating of 70-80 b.h.p. Wheelbase was 11 ft. 6 in. and overall length 19 ft. 9¼ in.

Mr. G. Taylor, of Redbourne, Herts., bought most of these engines, and some of the other owners of whom I know are given herewith:—

No. 9290. B6 Long Box Compound Locomotive. Delivered August 30th, 1902. Owned by Mrs. A. Forrest, Gravesend.

No. 9292. B6. Delivered November 29th, 1902. Owned by G. H. Hall, Belper.

No. 9295. B6. Delivered December 12th, 1902. Owned by W. Stokes, Basingstoke. Named 'Swift.'

No. 9296. B6. Delivered December 31st, 1902. Owned by J. Searle, Mitcham."

I trust that this short account of some grand old engines will interest your readers, and I know Mr. Pepper is only too pleased to give information on this subject to anyone who is interested or who contemplates building one.

Strangely enough, I myself have not done so, probably because I already have two locomotives under construction, as well as building a miniature car for my small son. However, there is still some time to "have a go" in the future.

Yours faithfully,

Leeds. GEO. L. CAWTHORNE.

Model Traction and Portable Engines

DEAR SIR,—Some builders of model traction and portable engines appear to be making errors through lack of authoritative guidance.

The wheels must be particularly studied to get them right.

Many of the engines had rubber tyres, which would be interesting to show on a model. Probably, enquiry to a firm of engineers' suppliers would reveal the existence of some large rubber rings or tubes in suitable sizes, from 4½ in. to 9 in. diameter, which could be adapted to suit.

The fine model built by Mr. Harwood has too few spokes in the wheels. This seems to be due to the fact that Mr. Greenly's excellent drawings were taken from a relatively small engine; but the fairground and very large contractors' engines always had more spokes than are fitted in Mr. Harwood's model.

Many of the portable agricultural engines are of considerable interest, and the photograph published recently shows, particularly well, the construction of the wheels; but in many of the earlier examples wooden wheels were used. A very characteristic feature of the "portable" was the governor, which should, if possible, be made to work.

Is it too much to hope that a series of dimensional drawings, and photographs, may be published, as in the case of railway locomotives, either taken from old catalogues or from existing examples, so that model makers may avoid mistakes caused by scarcity of authoritative information? Also, upon the steam roller.

Yours faithfully,

London, N.W.7. H. H. NICHOLLS